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APPLIED

HYDRAULICS

OCTOBER 1955

THE MAGAZINE OF
FLUID POWER
INCLUDING AIR CONTROLS
AND AIR CIRCUIT DESIGNS
• ELECTRICAL CONTROLS •

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National Conference on Industrial Hydraulics

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For more information about
THE MASTER CATALOG OF FLUID POWER PRODUCTS
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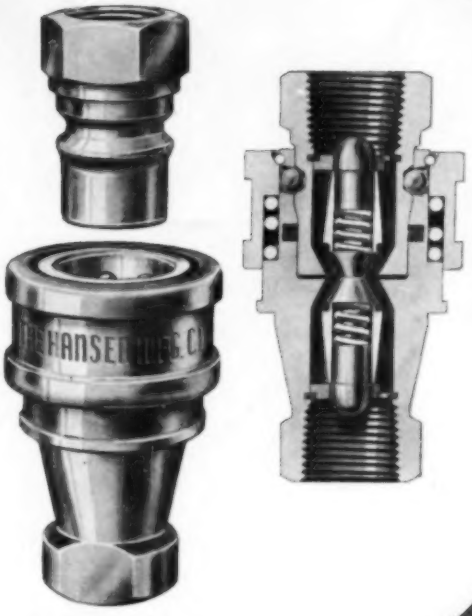
HANSEN

QUICK-CONNECTIVE

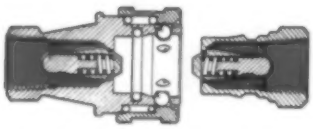
2-WAY SHUT-OFF

COUPLINGS!



QUICK CONNECTION AND DISCONNECTION

INSTANT AUTOMATIC FLOW OR SHUT-OFF



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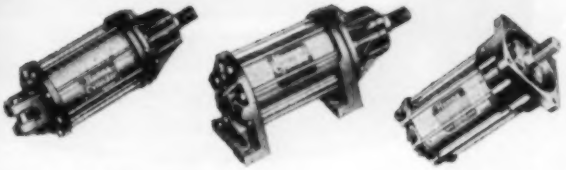
The new Hanna T750 Series cylinders are the last word in smooth, dependable performance. These rugged, compact cylinders are built for air operation to 250 p.s.i. and oil or water operation to 750 p.s.i. Many mounting styles and interchangeable heads make these cylinders exceptionally versatile. Available in 1½", 2", 2½" and 3" diameters.

WRITE FOR CATALOG 750A

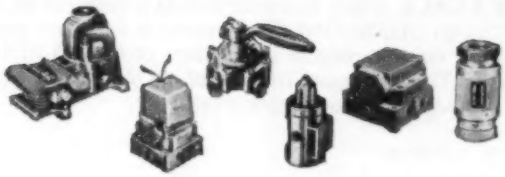
Hanna LP
AIR & HYDRAULIC CYLINDERS



For low pressure air and hydraulic operation. Thousands of varied applications have proved the quality and reliability of these Hanna cylinders. Bore sizes range from 4" to 14". These cylinders, combined with Hanna T750 Series cylinders, offer a complete range of cylinder sizes and mounting styles. Made in any practical stroke length.

WRITE FOR CATALOG 236A

Hanna
AIR AND HYDRAULIC VALVES



Designed to provide most efficient control for Hanna cylinders — ideal for other fine control jobs too. Many types available for hand, foot and electric operation, speed control, pilots and master for automatic and remote control.

Write for Catalog 254

Hanna Filters, Lubricators, Regulators, Traps

These accessories provide complete protection for precision-built cylinders and valves—will keep maintenance costs at a minimum.

Write for Catalog 105

Hanna HP
HYDRAULIC CYLINDERS

Hanna HP cylinders are without equal for strength, precision and power. For operating pressures up to 1500 p.s.i. Bore sizes range from 1½" to 8" in a complete selection of mounting styles. Heads are fastened directly to the cylinder tube, giving clean appearance.

WRITE FOR CATALOG 233B

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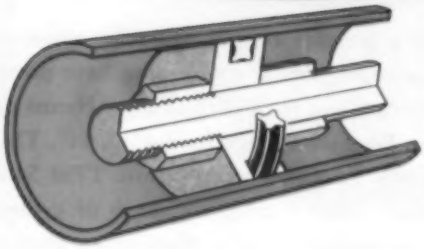
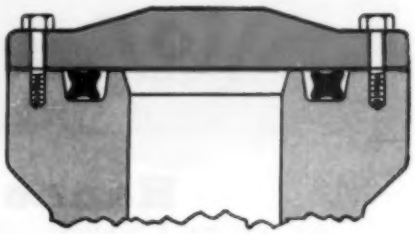
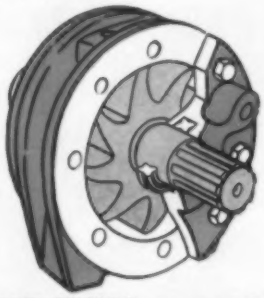
Revolutionary new hydraulic seal



1. **PACKING** for reciprocating motion in hydraulic and pneumatic devices. New design eliminates "spiral twist," a common cause for packing failure. Users have reported *much less drag and breakaway* in installations where QUAD RINGS have replaced O-Rings and other types of packing. Leading edge of QUAD RING acts as a wiper ring to minimize abrasion and prolong service life. QUAD RINGS form a *positive seal* under a wide range of pressures—are particularly efficient at 0 to 5 psi. Where O-Rings and other packings fail in performance, try QUAD RINGS.

2. **GASKETS** for sealing matching metal parts. The unique design of QUAD RINGS prevents excessive distortion under pressure and prolongs the life of the gasket. The four lips of the seal prevent "by pass" in devices using frequent pressure cycles. There is less "working action" of the gasket in the groove permitting a rougher groove finish. QUAD RING gaskets are made in a complete range of sizes corresponding in dimensions with O-ring gaskets—making them completely interchangeable with O-ring gaskets, eliminating any conversion costs.





3. **ROTARY SEALS** where hydraulic sealing is required on revolving shafts. Although QUAD RINGS are limited to moderate pressures, field reports show many successful applications of QUAD RINGS on rotating devices. The minimum friction of QUAD RINGS permit much higher rotation speed and longer service life.

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Free samples of QUAD RINGS are available in all sizes together with a descriptive brochure with technical information and installation data. We urge you to inquire about this revolutionary new seal today.

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APPLIED HYDRAULICS

VOLUME 8 NUMBER 10

OCTOBER 1955

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BPA

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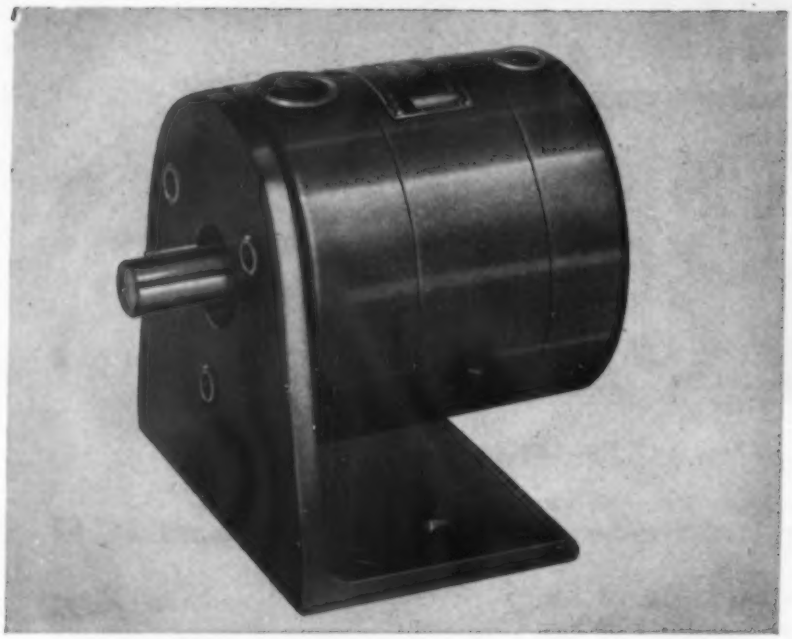

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LOW-PRICED

radial piston pump

Here is a hydraulic pump that provides the high performance characteristic of piston-type pumps—at a price usually associated only with pumps of vane or gear design.

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The Model D-5 illustrated is rated at 2000 PSI maximum—5 GPM—at 1800 R.P.M. using 235 SSU oil at 100° F. *The over-all efficiency is above 90% for a wide range of operating conditions.*

A simplified feed-back control with external valving can be utilized to accomplish variable displacement—with resulting advantages, such as constant pressure feed-back control, economy in horsepower, etc.

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1240 Ontario St. Cleveland 13, Ohio

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Subscription in United States and possessions—$5.00 per year; Canada—$6.00 per year; Foreign—$7.00 per year, except United Kingdom. United Kingdom subscription £ 2.5.0 per year, payable in Sterling to our London Office. Single copy price, 50 cents. All subscriptions subject to individual acceptance by the publisher.

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We are extremely proud of the privilege to include these leaders of industry among the steady users of Anchor Hydraulic Hose Assemblies, Couplings and Fittings. We've worked hard to earn this privilege so, naturally, we're proud, too, of these six solid reasons why our customers use Anchor Products —

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Fluid Power Lines

about Applied Hydraulics

PRIZE WINNERS . . . For the past three years, APPLIED HYDRAULICS has sponsored an annual Prize Paper Contest which has been open to all readers. 1955 winners of the $1200 in cash awards, and of honorable mention awards, are announced in this issue and the three top papers are published. All other prize winning and honorable mention papers will be published during the coming year.

First prize winner, Joseph H. Cohen, The Cross Company; second prize co-winners, Edward L. Bronstien, Jr. and Richard A. Fisher, The United States Bedding Co.; and third prize co-winners, John E. Minty and Raymond L. Ober, Manning Maxwell & Moore, Inc., will be presented their checks at the NCIH in Chicago.

Start planning your entry for the 1956 Contest now!

NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS . . . We hope you have made plans to attend the 11th annual NCIH which is being held October 27 and 28 at the LaSalle Hotel in Chicago. This is the only major technical conference which, each year, devotes its entire program to hydraulic and pneumatic subjects. The addition of pneumatics to the program was started last year. In this issue you'll find a complete guide to the Conference. The full program is published along with abstracts of most of the papers which will be presented. Our editors, Reed, Rolnick and Morris, will attend all sessions to bring back a full report of panel discussions for the December issue. We're looking forward to meeting you at the Conference.

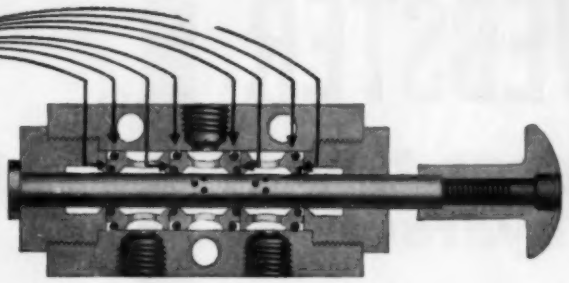
PIPE TESTING . . . A. J. Roeker, he's the hydraulic engineer at Florence Pipe Foundry & Machine Co., writes about the air controlled hydraulic circuit which this company uses on their hydrostatic test equipment. The control circuit automatically regulates oil hydraulic clamp pressure in respect to water pressure inside the pipe at all stages of the test.

"LOST OUR CARGO AT SEA . . . As a matter of fact we lose it every day." said the captain. "You see, mate, our cargo is garbage and our job is to dump it out in the Atlantic ocean. This used to be a pretty tough job till someone got smart and put hydraulics on my ship. Now I sit safely in the pilot house and flip levers to dump the load. Don't have to go out on a wet, slippery deck to yank on each hopper. Hydraulics is a real help, mate."

Dave Loomis, whose company designed the hydraulic system for the dump scow, tells about it on page 94.

COLLEGES AND HYDRAULICS . . . What can be done by colleges to train men for the hydraulics industry? Glenn V. Edmonson, professor, at the University of Michigan, tells about the modernizing of some of the basic courses and the addition of laboratory equipment which is being carried out to make the undergraduate more familiar with oil hydraulics.

8 Precision "O" Rings



keep this Control Valve **under control!**

"Quick-As-Wink" CONTROL VALVE

"Quick-As-Wink" Control Valves by C. B. Hunt & Son, Inc., Salem, Ohio, feature simplicity of design, rugged construction and ease of operation. *Precision* "O" Rings make these great features possible. *Precision* "O" Rings are specified for their extra quality which insures a longer life of trouble-free service. Have a sealing problem? Get it under control quickly with *Precision* "O" Rings—tough, compression molded, rigidly inspected—finest "O" Rings made!

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CHECK THESE FEATURES

- ✓ Heavy-duty anti-friction bearings throughout
- ✓ Temperature- and oil-resistant lip seal
- ✓ Smooth-running helical gears, precision-made and properly hardened
- ✓ Either end or side porting available
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- ✓ Over 100 models, 1/5 to 30 gpm, pressures to 1500 psi, speeds to 3600 rpm

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MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS FROM 1/5 TO 30 GPM CAPACITY

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Compressed air has a natural "bounce"—ideal for many operations. But where absolute smoothness of piston rod movement is essential, bounce can be troublesome.

You can make any air cylinder piston rod behave with Bellows Hydro-Check control, This precision control unit, mounted parallel to, or in line with the air cylinder, sets up an opposed, steadying control force that smooths out chatter instantly.

You can have Hydro-Check control when you want it—for a fraction of the stroke, or all of it. With certain models of Hydro-Checks you can have "Skip"—or intermittent checking action; or you can stop an air cylinder piston at any point in its travel for a predetermined time and then resume traverse. Hydraulic control can be on either advance or retract strokes or on both.

If you use air cylinders in precision operations, you'll want to know more about Bellows Hydro-Checks — precision hydraulic control for air cylinder power. Write for Bulletin HC-601 Address: The Bellows Co. Dept. AH 1055 Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd. 14 Advance Rd., Toronto, Ont.

The Bellows Co.
AKRON 9, OHIO

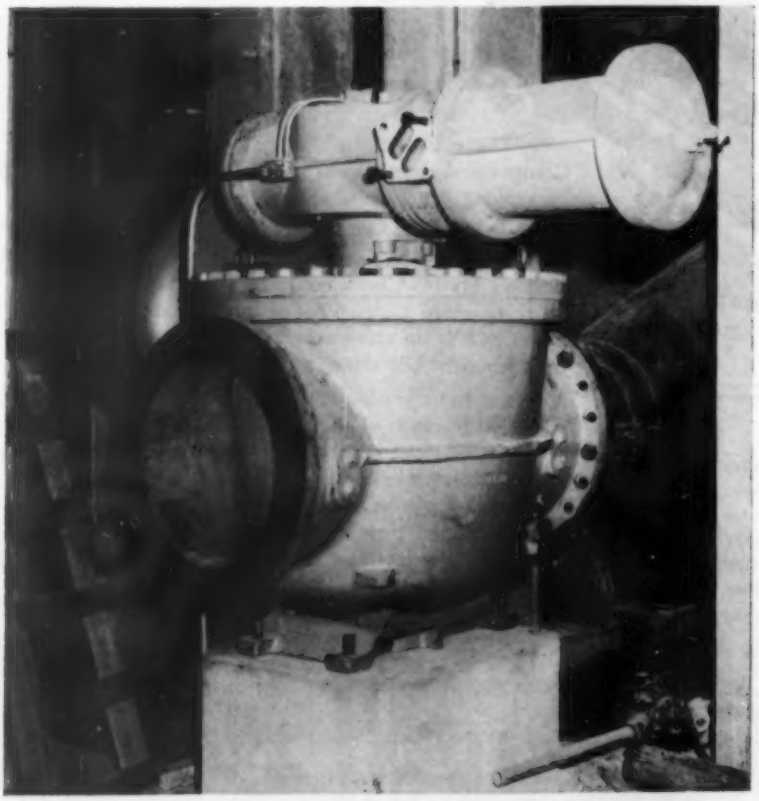
1223-A

BRIEFS about fluid power

GIANT WIND TUNNEL VALVE IS MOVED WITH OIL

Most recirculating type wind tunnels require several minutes before desired flow, temperature and pressure conditions can be established. For operating a 40 x 40 cm continuous wind tunnel, the Naval Ordnance Laboratory installed an unusual control system utilizing a special hydraulic valve. In this system piping is arranged so that proper air flow can be established in a by-pass line and then diverted to the wind tunnel in a matter of seconds.

In operation the tunnel simulator valve in the by-pass line is set up to provide identical flow conditions required in the tunnel. Then tunnel operation is initiated which causes a pair of hydraulically operated cone valves to open, allowing flow to take place in the tunnel in parallel with the by-pass line. The tunnel simulator valve has ten separately controlled ports. These ports are actuated by 650 psi hydraulic pressure provided from an accumulator system and flow can be varied over its entire range in less than one second. Control of the cone valves is by means of solenoids actuating a hydraulic cylinder which drives the valve's opening mechanism. Other hydraulically operated cone valves in the system are used for rapid changing of piping configurations and various pumping conditions. ▼▼▼



Aircraft Accessory Power

Making provisions for auxiliary power takeoffs on a new turbo jet engine is a problem facing powerplant engineers. Remotely located accessories have been recommended because installation flexibility permits many accessory combinations without changing engine configuration and higher speeds require smaller engine frontal areas.

Multiple systems, both electrical and hydraulic, have been suggested. Hydraulically, the trend is to split utility systems, such as landing gear operation, speed brakes and flaps, from the dual power control system used to fly the plane. This will require a third hydraulic pump on the accessory drive.

Remote accessories driven pneumatically by compressor bleed air

Continued on page 14

Increased *production* without a sacrifice of *precision* is the quest of American industry in this era of automation. Hydraulic cylinders are a vital component in today's automatic machinery. In the Model J Hydraulic Cylinder, Hydro-Line has designed and built an automation cylinder that not only meets all JIC and industry standards but assures uninterrupted performance and safety for both heavy duty work and non-shock service.

Wide Choice of Mountings

"JA" FIXED FOOT MOUNT
"JG" CLEVIS MOUNT
"JR" REAR FLANGE MOUNT
"JX" BASIC CYLINDER
"JB" ROTATABLE FOOT MOUNT
"JF" FRONT FLANGE MOUNT
"JT" TRUNNION MOUNT
SPECIAL MOUNTINGS

CYLINDER TUBE—All-steel, heavy wall, precision bored and honed for the most exacting machine tool applications.

PORTS—Ports are of adequate size and completely unobstructed to allow unrestricted flow.

END CAPS—Unbreakable end caps and mountings machined from solid steel bar stock . . . designed for lifetime, trouble-free service. End caps are retained by heat treated socket head cap screws.

REMOVABLE CARTRIDGE GLAND—This is a heavy duty bronze package-type gland which incorporates self-compensating, non-adjustable, leak-proof lipseal and wiper-seal designed to wipe both ways so as to provide dry rod on outstroke, a dirt free rod on instroke. Cartridge easily removed without disturbing cylinder assembly.

CUSHION ADJUSTMENT AND BALL RETAINER—Interchangeable cushion adjustment and cushion ball check provide simplicity and easy maintenance. (Cushions optional.)

PISTON RODS—Heat treated, stress relieved, ground, polished and hard chrome plated piston rods for maximum rigidity, long life and resistance to scoring.

WRENCH FLATS AND ROD ENDS—Wrench flats and rod ends designed to facilitate replacement of seals and cartridges *without dismantling cylinder.*

PISTON RINGS—Step-cut joint piston rings seal in both directions assure long life and minimum leakage.

Write for Data on the Complete Line of Hydro-Line Air and Hydraulic Cylinders

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Gentlemen:
Please send latest literature and specifications on Hydro-Line Hydraulic cylinders.

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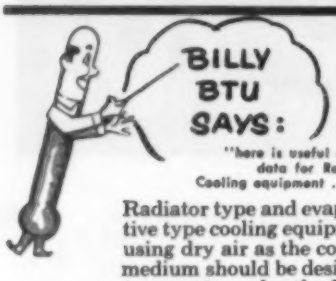
HYDRO-LINE REPRESENTATIVES IN ALL PRINCIPAL CITIES FOR CONSULTATION, RECOMMENDATIONS AND DATA

Young Heat Transfer News

YOUNG RADIATOR COMPANY, RACINE, WIS.

Lufkin Selects Young Coolers to Reject Heat of Friction in Speed Increasers



Radiator type and evaporative type cooling equipment using dry air as the cooling medium should be designed to operate under the DRY BULB air temperatures to be expected during the summer in the locality where the equipment is to operate. Equipment using cooling effect due to water evaporation is designed to operate under the WET BULB air temperatures to be expected.

For proper design, it is not satisfactory to use either the maximum air temperature, nor the average air temperature. Use of the maximum air temperature for design would result in the selection of cooling equipment too large to be economical, since it would be fully loaded only under the most extreme temperature conditions. Use of average temperature for design purposes would result in selection of equipment too small to handle the cooling load during a great portion of the operating time. It is necessary, therefore, to use some figure between maximum and average air temperatures.

The Young Radiator Company has prepared and offers to engineers engaged in the design and application of radiator type and evaporative type cooling equipment, data taken from the results of five years of summer records in the United States. This data may be used and considered as applying to an average year.

For a copy of this data, write for Bulletin 654, Young Radiator Company, Racine, Wisconsin.

WRITE FOR FREE DESIGN TEMPERATURE BULLETIN OF THE UNITED STATES

Helpful four-page Bulletin briefly discusses atmospheric cooling equipment design temperatures for the United States. Wet and dry bulb maps are fully illustrated with isothermal lines. Write Young Radiator Company, Dept. 445-K, Racine, Wisconsin.

Extend bearing life, improve lubrication with Young Cooler

Lufkin Foundry and Machine Company, Lufkin, Texas, specifies Young Radiator Company Type "F" Shell and Tube Heat Exchangers to cool Speed Increaser lubricating oil.

The Lufkin Type N3012 Speed Increaser weighs 12,000 pounds and will drive a 99 horsepower, 3,600 rpm centrifugal pipe line pump.

Gears and bearings are lubricated by force feed from a lubricating pump. Oil is picked up from the bottom of the pump and passed through the Young two-pass Heat Exchanger and flows to the bearings and gear mesh.

Oil cooling is necessary with Speed Increasers because a percentage of the horsepower applied to the input side is used in overcoming friction. This horsepower loss is converted into heat giving rise to oil temperatures of 220 F., or higher. By lowering the oil temperature lubrication is improved and bearing life extended.

Recognized for their compactness in design, Young Heat Exchangers are used for any kind of fluid to fluid cooling. Single or multi-pass units, in fixed or removable tube bundles. Available in ferrous or non-ferrous metals for quick delivery from stock. Write for free catalog No. 1254.

Lufkin Type N3012 Speed Increaser designed to drive a 900 hp pipe line pump, and cooled by Young Radiator Company Heat Exchanger (encircled).

Young Type "F" two-pass Fixed Tube Bundle Heat Exchanger used on Lufkin Speed Increaser.

Young RADIATOR COMPANY

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Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation, and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

. . . a new, more powerful, more versatile

HYDRAULIC-PNEUMATIC POWER DEVICE

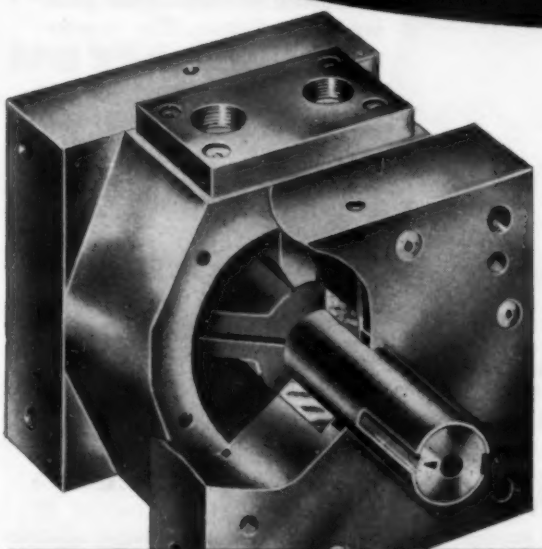
for industrial machinery, machine tools, construction, materials handling and processing equipment . . .

The Rotomation Motor

FOR

MAXIMUM TORQUE OSCILLATING ROTARY POWER

TO TURN, LIFT, CLAMP, PUSH, OPEN, CLOSE, INDEX, FEED, LOCK, MIX, AND MOVE!



Operates at top efficiency on air . . . oil . . . water, or fire-resistant fluids.

- **Supplies full power torque in a fraction of a second.**
- **Exhaustively tested by largest auto-maker—proven to have greater power, higher speed, and 50 TIMES LONGER LIFE!**
- **Completely adaptable to original equipment or as a replacement unit.**
- **Engineered for simple, economical application to automation systems or single unit equipment.**

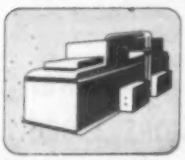
● Meeting the most exacting specifications of the machine tool and automation fields, *the Rotomation Motor is now industry's first choice* . . . because it eliminates complex linkage, gearing, and other cumbersome devices . . . because of its compact square design and rugged construction.

These Rotomation Motor features assure *low initial cost* . . . *low operating cost*—and *minimum space* required in application.

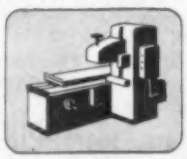
The Rotomation Motor offers *full-power torque oscillation in seconds* . . . six mounting faces . . . fourteen mounting models . . . four shaft styles, complete with standardized controls, fittings, and devices . . . available in sizes capable of moving ounces or tons.

The foremost rotary power producing advancement of the day—the Rotomation Motor is designed, engineered, and built to meet the most rigorous demands of industry . . . now and in the future!

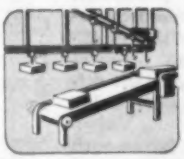
HERE ARE JUST A FEW OF THE MANY APPLICATIONS OF THE ROTOMATION MOTOR!



Washers, Explosion-Proof Mixers, Dust Collectors, Tanks, etc.



Lathes, Grinders, Presses, Screw Machines, etc.



Conveyors, Trucks, Hoists, Cranes, Lifts, Elevators, etc.

Dump Trucks, Scrapers, Mixers, Earth Movers, Shovels, etc.

Winches, Derricks, Rams, Turn Tables, Windlasses, etc.

Pumps, Tankers, Transfer Equipment, Pipe Line Boosters, etc.

ROTO-MATION MOTORS INC. "A LONG ENOUGH LEVER . . . AND WE COULD MOVE THE WORLD"

Roto-Mation Motors Engineers will be glad to assist and advise you on rotary power requirements and problems. Write or call. No obligation.

Send for the Rotomation Motor Manual. Gives complete specifications — illustrates applications. Sent free on request.

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NEW BACK PRESSURE RELIEF VALVE...

SHUTS OFF TIGHT

WITH PRACTICALLY NO PRESSURE DROP BELOW RELIEF SETTING

EXTRA LARGE CAPACITY

For Pressures From 0 to 400 Pounds P.S.I.

Chatter Free • Low In Cost • Unusually Sensitive

- Available in iron, bronze, monel or stainless body. Size ½ to 2" inclusive, with bronze, monel or Neoprene diaphragm.
- Suitable for use on practically all fluids and gases. Especially suited for oils of all grades, including Bunker "C".
- For additional information on Type FR, and other new automatic valves in the Cash-Acme line, write our Engineering Department at the address below. To avoid delay, please include a brief outline of your pressure conditions and requirements.

Cash-Acme's Type FR back pressure relief valve automatically maintains correct pressure on the inlet side, by relieving into a lower pressure line. It is not affected by pressure variations on the discharge side. Provides protection against periodic high pressure conditions. Can be used with modification as a differential pressure regulator—holding a constant difference in pressures between valve inlet and valve outlet. Valve action is fully floating for smooth and even control. New patented "Floating ring" is unusually sensitive—gives exceptionally good closure. Large capacity in almost frictionless performance.

CASH ACME

A. W. CASH VALVE MANUFACTURING CORP.

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The Complete Cash-Acme Line Includes Pressure Reducing and Regulating Valves, Relief Valves, Back Pressure Valves, Vacuum Regulators and Vacuum Breakers, Differential Pressure Regulators, Strainers, Diaphragm Control Valves.

I—5-55

BRIEFS continued

are no longer favored because of the high temperatures developed by turbo jets, which makes bleed air too hot to handle. Also, the synthetic oils which are used may leak past engine seals and contaminate the bleed air. ▼▼▼

Hydraulically Controlled Counterweights

Caterpillar Tractor Company's new pipelayer features hydraulically actuated counterweights, pivoting at the bottom. The counterweights, of new design, are split

on each side of the winch mechanism. Hydraulic cylinders position the counterweights to balance the moving load. Consisting of 12 segments weighing 1108 pounds each and a frame of 5380 pounds, the counterweight unit has a total extendable weight of 18,676 pounds. When counterweights overhang 8 feet they can balance a load of 63,100 pounds. ▼▼▼

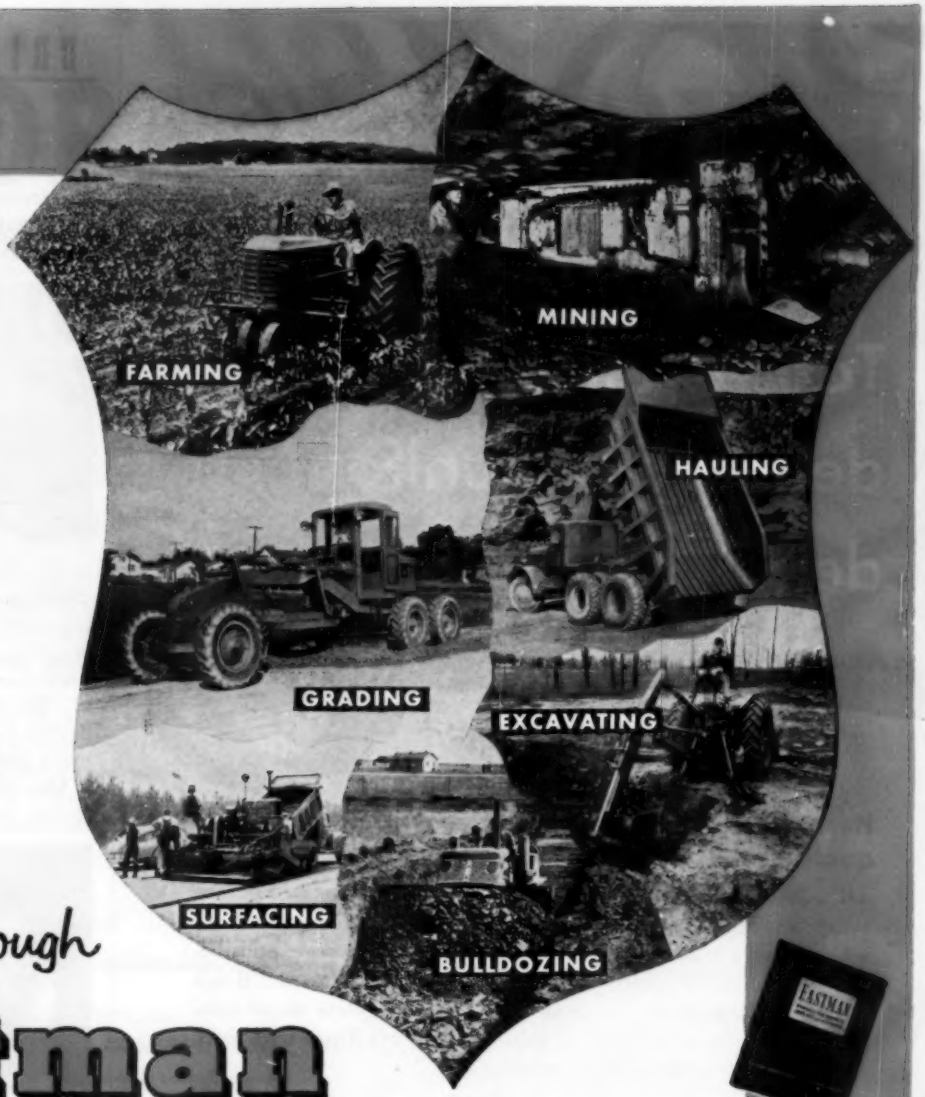
Increased Air Power Applications Speed Automobile Assembly

Use of compressed air has been credited in many instances for obtaining greater productivity, lower costs and safety. Ford Motor Co.'s Lincoln-Mercury Division Los Angeles plant, which employs approximately 1200 persons, has over 400 pneumatic tools in use.

Three rotary-vane type air compressors of 1000 cubic feet per

Continued on page 16

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*



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HYDRAULIC HOSE ASSEMBLIES

EASTMAN — *first in the field* of Hydraulic Hose Assemblies—has had the privilege of *pioneering* in many original applications of hydraulic power — on equipment made by many of America's leading manufacturers — as shown in action in the industries, above.

Modern industry not only moves *hydraulically*, but with increased efficiency and economy—with improved production and performance . . . the kind of performance that improves your competitive position in your field.

If you have a power transmission problem, consult with Eastman Engineers. For improved performance due to many original exclusive Eastman designs . . . for quality of material and workmanship—always specify Eastman Hydraulic Hose Assemblies.

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Top quality O-Rings, dependably uniform, delivered on time!

Here's the way National insures uniform high quality in National O-Rings:

All ingredients are of highest quality, carefully inspected before compounding. Compounding is done under strict controls to insure absolute uniformity of batches. Molding is done on modern equipment by skilled veterans in O-Ring manufacture. Rings are given a complete precision trim, then complete inspection. Every precaution is taken to insure that no O-Rings with cuts, scratches or mold defects are shipped.

A complete line of industrial O-Rings, including the new small cross-section rings, is available for prompt shipment from convenient warehouses. Prices are most competitive. Call the nearest National Applications Engineer and prove this to yourself!

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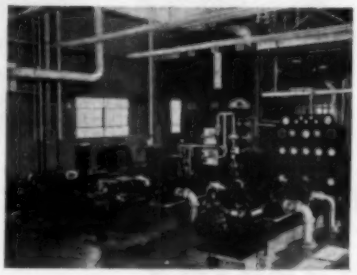
REDWOOD CITY, CALIF. . . *Broadway and National, EMerson* 6-3861
WICHITA, KANSAS . . . . . 519 *South Broadway, WIchita* 2-6971

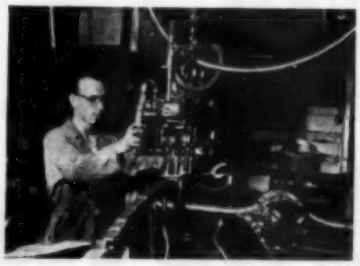
BRIEFS continued

minute capacity each handle the ever increasing load. The assembly plant now uses 1,700,000 cubic feet of air every 24 hours. Output

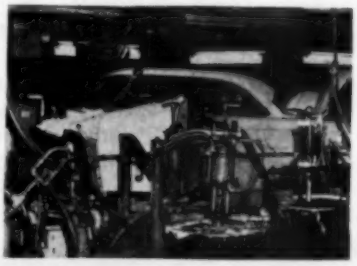


is from two of the three units which are operated on an alternating basis. Air power, used from the point where air hoists lift body parts from box carts to the assembly line until the assembled automobile rolls off the line, has saved many hours of manual efforts.

One worker can now fasten four spring shackle bolts in the time



formerly required for one by using a multiple U-bolt pneumatic wrench. Also a five spindle nut runner used on the wheel assembly has increased production. Pressure regulators are used so that the torque is set for each nut, to assure uniform tightness.



Sealing fluids and rubber cement are all applied under air pressure. In order to maintain even pressures and eliminate long lines, 18 pressure tanks were

Continued on page 18

HYDRAULIC POWER

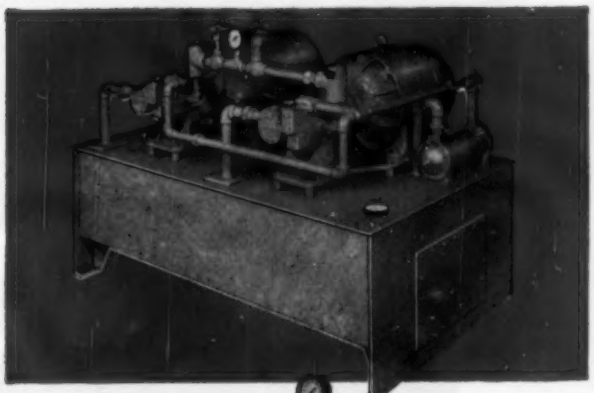
POWER UNIT MODEL SP-3054

Tank Capacity: 200 Gallons
Motors: Two 15 HP—TEFC—1200 RPM
Delivery 19.6 GPM @ 1250 PSI,
9.8 GPM @ 2000 PSI each pump
Application: Paper Making Machinery

Let Cardwell help you design and engineer the Hydraulic Power Units required for your specific job . . . write for descriptive catalog and further information.

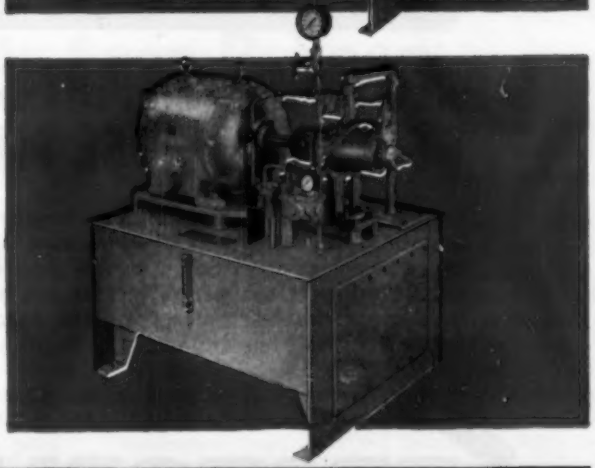
POWER UNIT MODEL SP-2954

Tank Capacity: 100 Gallons
Motor: 7½ HP—1800 RPM—TEFC
Delivery: 16 GPM @ 600 PSI
Application: Rolling Mill Machinery



TYPICAL CONTROL PANEL

Hydraulic control console for section of paper making machines. Control panel permits accurate pressure control of rolls.



POWER UNIT MODEL SP-1254

Tank Capacity: 50 Gallons
Motor: 15 HP—1800 RPM
Delivery: 4 GPM @ 5000 PSI
Application: Missile Test Unit

CARDWELL MACHINE COMPANY

Quality — A CARDWELL TRADITION SINCE 1829

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• PRECISION • WEIGHT-SAVING
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Designed for extra strength, free flow and light weight. Precision made in Aluminum or Steel. Wide range of sizes and types in standard designs carried in stock. Special designs made to your specfications. Write for FREE catalog or order through your dealer.

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BRIEFS continued

spotted at locations close to the points of applications.

These are just some of the operations where adaptability of compressed air has helped to solve many production problems.

Photographs Courtesy Compressed Air and Gas Institute.

▼▼▼

52 Hydraulic Presses . . .

. . . capable of producing 17 different types of projectiles, have been installed at Mullins Manufacturing Corporation. They are part of an installation of equipment to produce projectiles by its Koldflo cold extension process. ▼▼▼

Electronics And Automatic Production Symposium

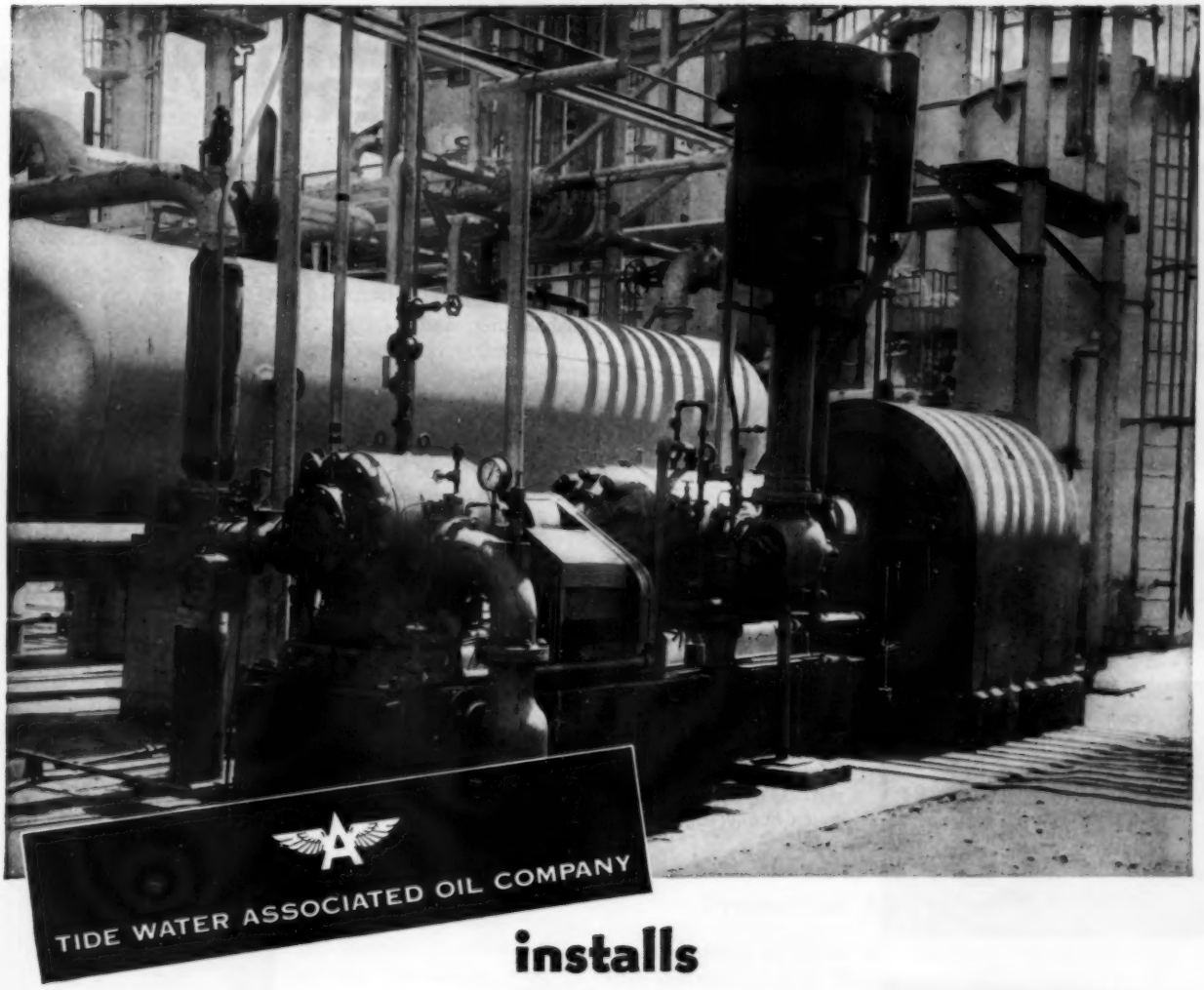
Stanford Research Institute and The National Industrial Conference Board, Inc., jointly sponsored this symposium held at the Sheraton-Palace Hotel, San Francisco, on August 22-23. Here are some quotations from papers presented.

". . . I believe that the thing that is new about automation, and that is therefore responsible for the unusual interest in the subject today, is the advent of electronic methods of control and computation . . . today's automation—it is essentially a field of tool-making for the enhancement of the efficiency of the frequently nontechnical operations of business and industry."

Dean A. Wooldridge, president, Ramo-Wooldridge Corp.

". . . The steel industry faces at least two problems in which automation can be a significant factor.

Continued on page 22



installs fuller rotary compressors in its Avon Refinery

When Tide Water Associated needed additional air for various operations in its Avon plant, its engineers investigated the possibilities of the Fuller Rotary Compressor. After making a thorough study of its merits, Tide Water purchased and installed two C-300-300H two-stage units, each supplying 1598 c.f.m., 100-lb. air for general plant use, one of which is shown above. Note that this machine is installed out in the open with no protection from varying weather conditions, operating 24 hours per day, seven days a week.

These two-stage machines are located in different departments of the plant to best meet the air-load requirements of the particular department being served.

Tide Water also has installed in this same plant, two C-300 Fuller Rotary single-stage compressors with a capacity of 1542 c.f.m. each, at 40-lb. pressure, used in the catalyst-cracking process.

Hundreds of Fuller Rotaries are serving the petroleum industry, proving their worth for general plant air, purging gas, refrigeration in alkalization units, and handling butane-butylene in the refinery, as well as in the field for pressure boosting and gas gathering.

Simplicity of construction has proved to be one of the important factors—no valves to leak, no seats to grind, results in maintained capacity for the life of the machine; simplified drive eliminates power transmission losses. For full information write us for Bulletin C-5A.

Fuller
. . . . pioneers in harnessing AIR

FULLER COMPANY, Catasauqua, Pa.
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at no extra cost to you . . .

NEW Quality Features on All AIR and HYDRAULIC CYLINDERS

Miller

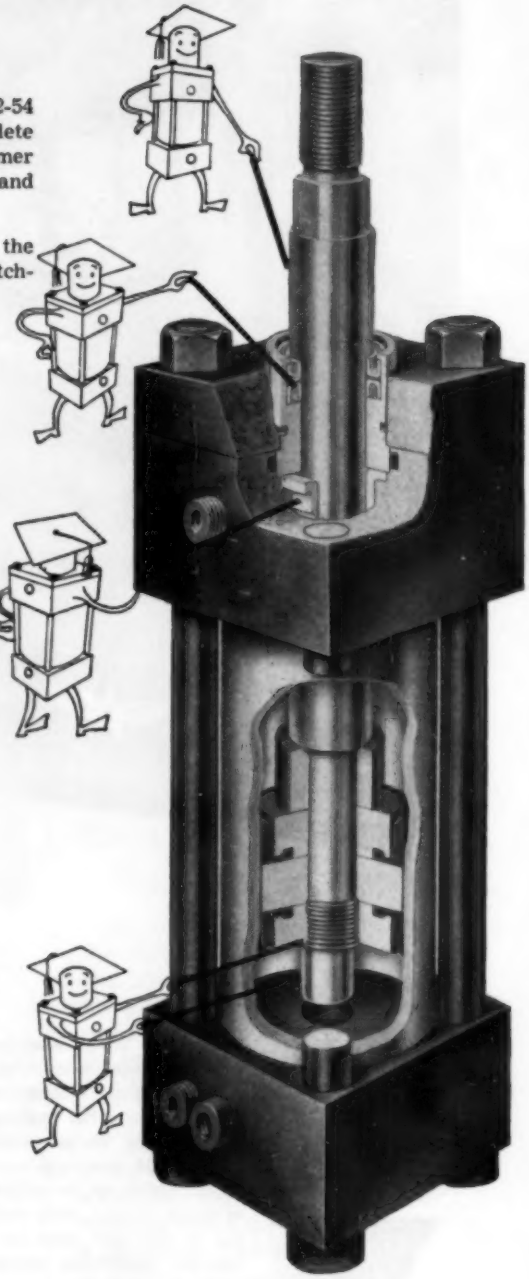
CASE HARDENED CHROME PLATED PISTON RODS

On all Miller Air and Hydraulic Cylinders

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences.

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust.



"TEFLON" WIPERS

On all Miller Air and Hydraulic Cylinders

Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Seals withstand temperatures from —100° F. up to 500° F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use.

"TEFLON" HYDRAULIC ROD SEALS

On all Miller Hydraulic Cylinders only

RUST RESISTANT SURFACES

On all Miller Air and Hydraulic Cylinders

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, and the unplated portions of the piston rods have this finish. It is not recommended for water service.

WRITE FOR CYLINDER BULLETINS H-104 and A-105

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

Over 8,000 Different Cylinder Selections Available for Immediate Delivery. Write for Complete List.

EFFECTIVE DATES

These new Miller features will be provided at no extra cost after January 1, 1956—and at Miller's option prior to that date.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • TOLEDO • CINCINNATI • COLUMBUS
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TORONTO, CANADA and OTHER AREAS

Miller

MILLER FLUID POWER CO.

2008 N. Hawthorne Ave. Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

Four More Miller Firsts . . .

Our "Report To Cylinder Users" was a simple statement of Miller Fluid Power Company's policy. In it was mentioned our dedication to the constant improvement of our products.

In line with this policy, here are new quality cylinder features that will eliminate many of the problems which you have reported to us.

Miller gave cylinder users one of its firsts when we chrome-plated all cylinder piston rods. Our reason was obvious. Chrome-plating gave every rod a mirror-like finish that no corrosive or abrasive dust could scratch. Miller made this chrome-plated, longer lasting rod standard. AT NO EXTRA COST.

Preventing Damage To Piston Rods

There were still plenty of hazards to which piston rods were subjected. A careless workman with a too handy wrench or pair of pliers meant a scored piston rod. A falling object striking the rod dented the softer metal beneath the plating of chrome. A jolt during assembly left its trouble-breeding mark. All of these nicked and scored the piston rods, damaging the whole assembly. Little could be done about this beyond repair and replacement—until the Miller announcement that from now on the piston rods on all cylinders—air and hydraulic—will be specially hardened (52-54 Rockwell C) to foil the carelessly used tool, the accident in transit or assembly, the falling object or unnoticed knock. Naturally, the new hardened rods will still be chrome-plated. Miller will now make this super quality an everyday standard. AT NO EXTRA COST.

Meeting The Challenge Of The New Demands On Seals

Rod seals on Miller hydraulic cylinders were constructed to be leakproof under all ordinary operating conditions. We guaranteed this. But we also stated in all our catalogues that for special conditions there must be special rod seals at an extra cost. Rod seals to withstand high temperatures had to be specially constructed. Where fire resistant fluids were used, special rod seals had to be provided at an extra cost. Because many fire resistant fluids destroy ordinary packing.

The present widespread use of these fluids and excessive heat generation from high speed operation and increased loads have resulted in reports of trouble on cylinders where ordinary seals were subjected to these hazards. These reports were not received with joy at Miller, even when the fault was definitely not ours. We don't like to have trouble develop on any Miller installation under any condition. So we decided to do something about these problems of the rod seals.

A new expensive material known as "TEFLON" has been developed for use as seals. This material is impervious to temperatures from —100° to plus 500° F. It resists all known fluids, even the most destructive of the fire resistant fluids. Now, every piston rod on every Miller hydraulic cylinder will be fitted with "TEFLON" Piston Rod Seals. AT NO EXTRA COST.

In addition, all rod wiper seals on all Miller Air and Hydraulic cylinders will be of the same chemical-and-heat resisting Teflon material.

These Teflon rod wiper seals will be standard on every Miller cylinder, regardless of how and where it will be used. This is Miller's way of doubly insuring cylinder users against all possible hazards. AT NO EXTRA COST.

Protection Against Rust

The barrels of Miller air cylinders are of moisture-resistant brass. The barrels of hyraulic cylinders, since they run in oil, are protected once they are installed and in operation. Beyond this all cylinder parts are subject to rust and corrosion. Such exposed parts as heads, caps and tie rods quickly show the unsightly evidences of rust. At least this has been so up till now. But all this is now being corrected.

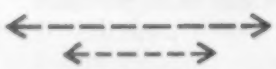
From now on Miller will protect all these parts on both air and hydraulic cylinders with a black oxide process in which a chemically created ferric oxide coating is developed on the surface of the metal to protect against rust and other corrosion. Every Miller cylinder sold will carry this added protection. AT NO EXTRA COST.

These four new Miller firsts are added to the many firsts established by Miller. Like other Miller firsts which created new departures in cylinder design and construction, these are now offered as Miller standard specifications. AT NO EXTRA COST.

MILLER FLUID POWER COMPANY
2008 N. Hawthorne Avenue
Melrose Park Illinois

HYDRECO Oil Power

OFFERS ENGINEERS- CUSTOM DESIGN in HYDRAULIC CYLINDERS!



Even simple functions may entail special configurations to give maximum results...

Or, when the function involves motion in more than one direction, custom design develops mountings to suit the application...

Or cylinder movement in any direction, and many other variables are yours with HYDRECO Custom Design.

For the engineer whose target is equipment that will outperform any comparable unit—the special facilities offered by HYDRECO can materially assist in attaining the objective. Not with so-called "standard" cylinders but rather with cylinders custom engineered and built to do the specific job.

Requirements of space, mounting, or hydraulic connections that could never be met by "standard" cylinders, can be fulfilled easily through custom designing.

And too, HYDRECO's variety of experience in designing and building special hydraulic components in volume production can keep the product costs within the budget.

That which is true of HYDRECO Cylinders is equally true of HYDRECO Pumps, Motors and Valves. To improve the performance of existing equipment or to add functions *and* complete dependability to projected designs—look to HYDRECO Oil Power!

WRITE— *for full information today on HYDRECO Pumps, Motors, Valves and Custom Built Cylinders.*

HYDRECO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1104 EAST 222nd STREET • CLEVELAND 17 • OHIO
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

BRIEFS continued

These are the attainment of the lowest possible unit cost and the attainment of the highest possible quality. . . . Tomorrow's machines are going to be more complex. Maintenance and preventative maintenance policies are going to have a greater effect on manufacturing cost than in the past. Downtime on machines may be more prolonged, more costly unless we upgrade maintenance forces with long-range organizational planning."

W. K. Scott, staff engineer, Columbia-Geneva Steel Div.

". . . automation is only as valuable as the reliability of the machines. The initial trend in automation was toward larger and larger and more and more complex pieces of machinery. This soon reached a point of diminishing returns. Not only did the machines become so clumsy and inflexible that they rapidly reached obsolescence, but maintenance problems often made the huge machines almost worthless. If one small part failed to function, the entire operation went down. Sometimes an entire plant would have to close down because of the failure of one complex, vital machine. The latest trend is toward what we at Chrysler call integrated automation. We want small, fast, more simply constructed units that can be tied together by mechanical production aids into flexible automation units. These units do not look as ingenious as the large complex machines, but they are more spectacular in their production record."

Robert T. Keller, vice president, Chrysler Corporation.

". . . The degree of automation is determined as much from economic as from technological considerations. Small-scale operation can be profitable with simple batch-type equipment. To automatize such an operation would probably be folly. Large units producing low-priced products, on the other hand, must be extensively automatized to be profitable. . . . Whereas ten years ago the investment in

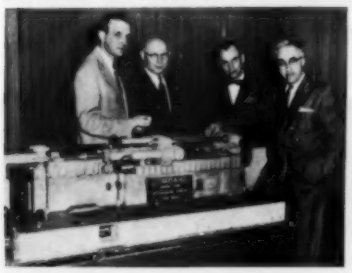
instruments was about one or two percent of the complete plant, it has risen to seven or ten percent on plants built during the past four years."

V. F. Hansen, Eng. Res. Lab., E. I. du Pont de Nemours & Co., Inc.

▼▼▼

Development of Extrusion Presses . . .

. . . from pre World War II to present time, was covered in a talk at the Youngstown Section of the American Society of Mechanical Engineers by Lt. Col. Desider A. Simcoe, Jr., chief of the Air Force's heavy press program. Colonel Simcoe discussed the part Germany played in the progress of handling light metals, starting as early as 1920 when they were building extrusion presses up to 10,000 ton capacity.



A working model of the giant 12,000 ton hydraulic extrusion press being built by Lombard Corporation for installation at the Torrance, California plant of Harvey Aluminum Machine Co., Inc., was featured. This will allow greater design flexibility in regard to size, weight and length of extrusions for various plane components. The operating pressure of this press will be 4285 psi and pumping capacity of the main hydraulic system 1400 gpm at 4500 psi.

▼▼▼

Hygiene With Hydraulics

Fluid power has been used to good advantage on a garbage truck built by City Tank Corporation. Known as the Roto-Pac loader, it is a totally enclosed all steel body, equipped with power raised tail gate, a reversible conveyor escalator for lifting refuse into the truck

Continued on page 26

Consider DUDCO Double Pumps with Valve Panels from the Standpoint of Their Ability to—

HELP SELL YOUR EQUIPMENT!

CONTROLLED FLUID POWER Contributes Added *Flexibility* to Machine Tool Performance

TWO VANES ARE BETTER THAN ONE

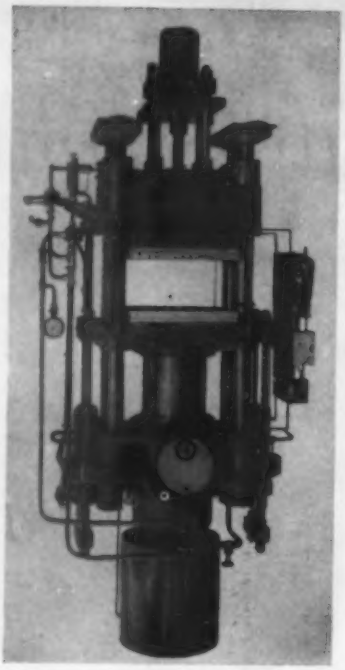
The hydraulically counterbalanced DUAL-VANES in DUDCO Hydraulic Pumps eliminate wear producing loads normally caused by unbalanced hydraulic forces and vane acceleration. DUAL-VANES also maintain MULTIPLE SEALING BARRIERS to slippage and power loss. DUAL-VANES are a patented and exclusive DUDCO feature.

DUDCO PF-100 Series Double Pumps with combination relief and unloading valves provide high circuit flexibility through either automatic or external pilot control. For example...in a "hi-lo" circuit, large volume delivery is available for a fast traverse cycle. Then, during the feed cycle, when small volume is required, one pump section unloads automatically...saving dollars in horsepower! These pumps can also be operated on separate circuits . . . each circuit protected by its own relief valve.

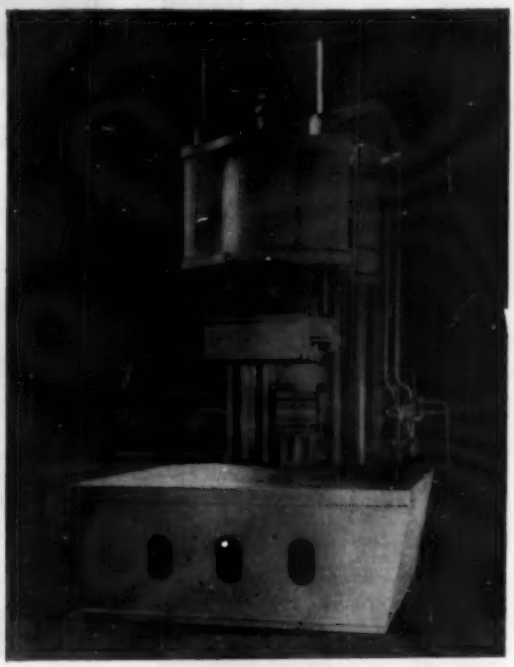
DUDCO Pumps can operate *continuously* at 2000 psi. Their exclusive "Dual-Vane" feature and advanced design combine to assure long, trouble-free performance and maximum simplicity in servicing. Thus, they are a natural choice for a wide variety of high production equipment, including: Machine Tools, Hydraulic Presses, Die Casting and Plastic Moulding Machines, Closing and Clamping Devices and other functions calling for controlled variation in Pump volume.

The PLUS factors in DUDCO Pumps weigh heavily at the sales end—so, WRITE...get the facts on DUDCO Dual-Vane Hydraulic Pumps and Fluid Motors.

DUDCO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1704 EAST NINE MILE ROAD • HAZEL PARK • MICH.
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

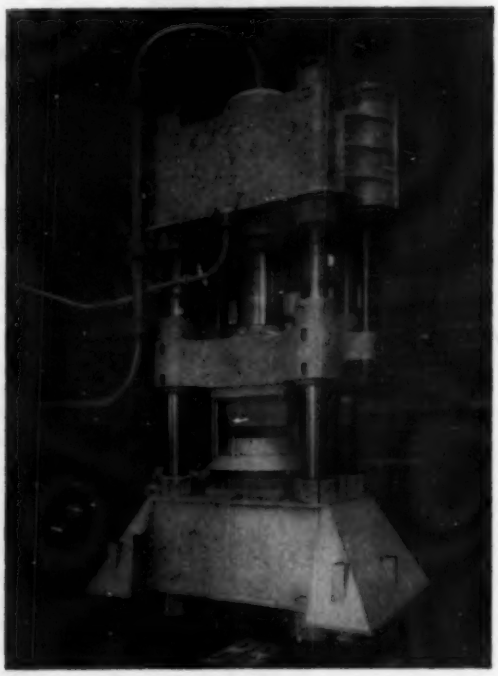


250 ton Transfer Moulding Press for Thermosetting Plastics.



750 ton Flanging and Joggling Press.

300 ton Twin Ram Plain Upstroke Press for Sponge Rubber Sheet.



2,000 ton Steam Hydraulic Forging Press.

The Hydraulic Association of Great Britain

94/98 Petty France, London, S.W.I. England

Telephone: Abbey 1845 Cables: Crusade Sowest, London

The Hydraulic Association of Great Britain

. . . Members of the Hydraulic Association build and supply complete units, components and systems for every industry. Designed by experts and built by craftsmen using the finest materials obtainable, these products uphold the British tradition of quality. In factories everywhere British Hydraulic Equipment of all types is being specified by far-sighted buyers who cannot afford costly breakdowns and cannot risk profits by purchasing inferior machines.

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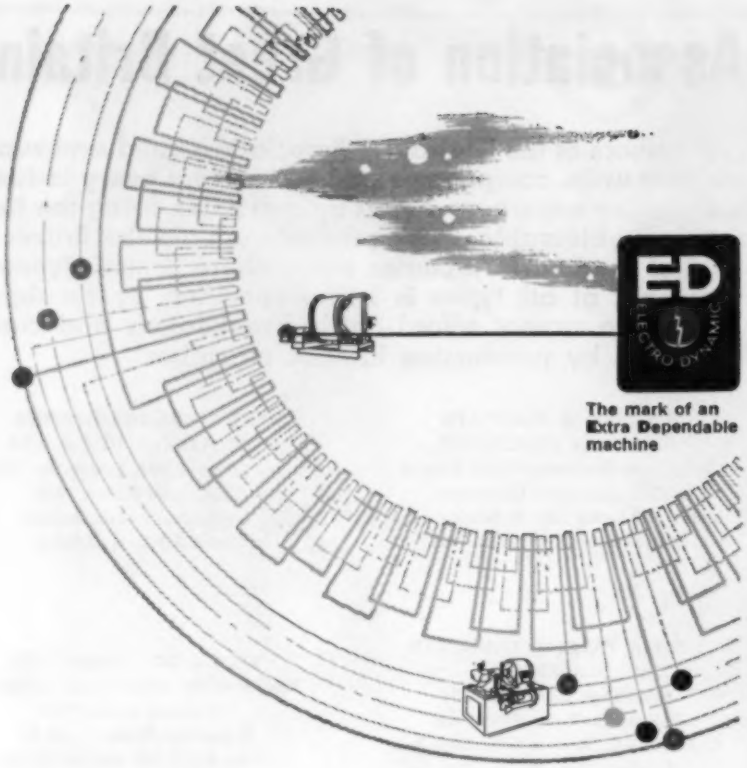
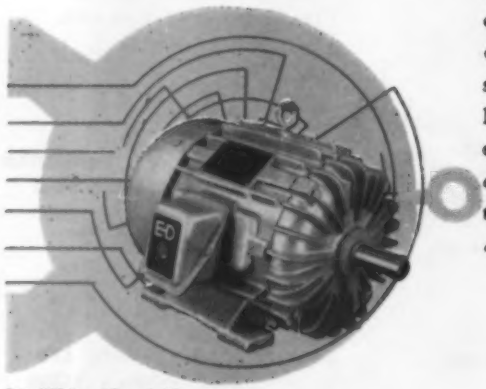


The mark of an Extra Dependable machine

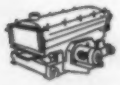
a better kind of power

FOR INDUSTRIAL MACHINES



1 to 250 hp. AC and DC. N.E.M.A. standards.

Extra starting and anti-stalling capacity: Extra cool, extra quiet operation: Achieved without sacrifice of full-load efficiency. Backed by unparalleled experience, E.D. motors are *extra dependable*—75 years in the making—yours today *at no extra cost!*



ELECTRO Extra DYNAMIC dependable motors

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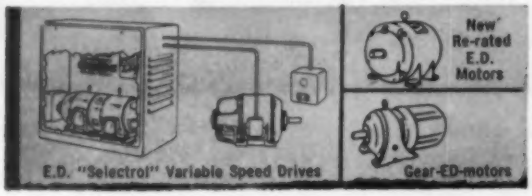
PRODUCT OF GENERAL DYNAMICS

NEW...

Write for Brochure 100 and literature on new E.D. motors and drives.

Electro Dynamic division of General Dynamics Corporation Bayonne, New Jersey



BRIEFS continued

and a powerful rotary pusher plate operated by roller chain drive from escalator head shaft for moving the garbage forward and compressing it into every part of the truck.

A control lever in the cab puts the unit into operation. One twin cylinder double-acting telescopic hoist raises the body to its maximum dumping angle of 50 degrees. The tail gate is also raised and lowered hydraulically. A fluid motor connected to head shaft through flexible coupling, enclosed worm gear and a precision roller chain drive, operates the conveyor. This power package is normally covered by a steel housing. ▼▼▼

Fluid Power Books

"Hydraulic Operation and Control of Machines" by Ian McNeil was recently published by The Ronald Press Company, New York. 319 pp. Price $7.50.

This volume contains 17 chapters ranging from an introduction and historical survey to the operation, care and maintenance of hydraulic plant and equipment. Basic theoretical considerations of hydraulics are well described and

Continued on page 28

Automate for top performance with . . .

T-J Spacemaker CYLINDERS

CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
T-J
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T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

Style SM5 shown

- The Only Cylinders with all the Extras as Standard
- Oil pressure to 750—AIR to 200 P.S.I.
- New Compact Design . . . Saves up to 40% Space
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- Hard Chrome Plated Bodies and Piston Rods (Standard)
- Only from T-J can you get these new ingenious cushion designs

More and more of industry's automation problems today—solved with T-J Spacemaker Cylinders! New compact design and many more plus features for a new high in efficient cylinder performance and dependability. Wide range of styles, capacities . . . to help you *save labor, reduce costs* on all kinds of push-pull-lift jobs. Send for bulletin SM-155-1. The Tomkins-Johnson Co., Jackson, Mich.

OFF SHELF DELIVERY

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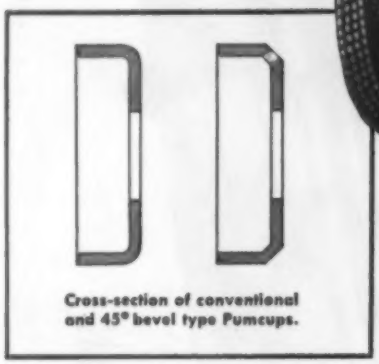
RIVITORS . AIR AND HYDRAULIC CYLINDERS . CUTTERS . CLINCHORS

2-way gain with Pumcups



Cross-section of conventional and 45° bevel type Pumcups.

Darcova Pumcups are available in various types and textures, in a complete range of sizes, to provide unequalled efficiency and long life in reciprocating pumps, air or hydraulic mechanisms.

★ prolonged high efficiency
★ less maintenance

TODAY hundreds of companies using hydraulic controls, air cylinders or reciprocating pumps are *standardizing* on Darcova Pumcups for piston packing, because they eliminate fluid slippage, costly down-time and maintenance.

Darcova Pumcups make the *most* of the cup packing principle. And, they are made in a complete range of sizes, types and texture-engineered compositions for various pressure-temperature-fluid conditions. Pumcups hold peak efficiency for the life of the cups and outlast other packing as much as 3 to 1.

Why not check these claims right in your own plant? Meanwhile get *all* the facts. Just send for Pumcup Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
TRADE MARK
Pumcups

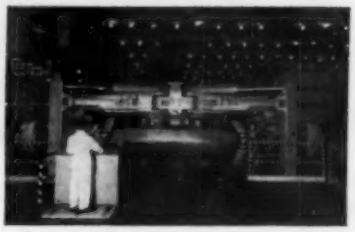
BRIEFS continued

simply illustrated. Present day development and future trends are also stressed. Designed to give practical help, the book includes many photographs and drawings, and a useful select bibliography.

"Centrifugal and Other Rotodynamic Pumps", Second Edition by Herbert Addison. Published by Chapman & Hall Ltd., London. 530 pp. Approx. American Price $8.00.

The author has revised and enlarged this edition to reflect recent advances made. It deals most with the questions likely to concern designers, makers and users of centrifugal pumps and allied machinery. The book is divided into sections entitled Principles, Design and Construction, Performance, Installation and Operation. ▼▼▼

Stretch Press Forms Titanium Sheets



Use of oil power gives accurate tension control and flexibility of movement to this machine which forms nacelles for DC-7 commercial transports at El Segundo Division of Douglas Aircraft Company. Hydraulic cylinders which clamp, wrap, stretch and form the sheets are controlled by an operator from a remote station. ▼▼▼

Pipe Tester Uses Plug Valve

In testing pipe sections of light wall steel pipe or copper tubing for leakage, it used to be necessary to weld caps over the ends, or in case of copper tubing to flair the ends, one cap being threaded to allow the introduction of air or water pressure.

Now, a tool developed by two employees of the Pacific Gas &

Continued on page 30

WHAT	WHERE	WHY
SUNVIS 900	**In tight systems** where oil is rarely changed and little or no make-up is needed.	**Exceptionally long life** of oil keeps overall costs low.
SOLNUS	**In tight systems** where make-up oil is less than 5% per month.	**Moderately priced**...excellent stability and rust protection.
SUNTAC	**In leaky systems** where make-up average is 5% or over per month.	**Reduced leakage** in systems cuts oil costs and downtime.
CIRCO	**In systems** where oil is continuously diluted by water, cutting fluids and other contaminants.	**Low-priced**...excellent protection where oil must be changed frequently.
SUNVIS H.D. 700	**In systems contaminated** by dust and deposits of sludge, varnish, etc.	**Cleansing action** removes deposits and eliminates costly teardowns.
LUBEWAY	**In dual purpose systems** of machine tools where hydraulic oil is also a way lubricant.	**Added film strength** of this hydraulic oil also eliminates "stick-slip" on ways.

CHART SHOWS WHERE AND WHY SUN HYDRAULIC OILS SAVE MONEY

As the chart shows, to operate your hydraulic system at maximum efficiency and minimum cost you must consider the condition of your hydraulic system, as well as pressures, operating temperatures and other usual factors.

And, very important, you must consider the age of your system. Continued use of original oil recommendations can be costly. A change in the type of oil can often result in substantial savings...especially where systems have developed leaks or where sludge and varnish cause excessive maintenance.

For complete information about how Sun hydraulic oils can help you cut operating costs of your hydraulic system, see your Sun representative...or write SUN OIL COMPANY, Philadelphia 3, Pa. Dept. AH-10.

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INDUSTRIAL PRODUCTS DEPARTMENT

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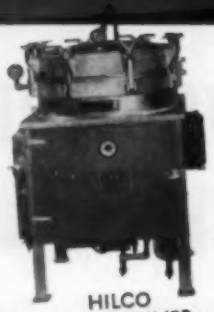
Keep YOUR HYDRAULIC SYSTEM Clean with HILCO HYDRAULIC OIL FILTER

- No More Varnish and Sludge Deposits
- No More Flushing and Manual Cleaning
- No More Frequent Oil Changes
- No More Accumulation of Dirt

Filter life up to a year eliminates usual frequent draining, refilling of systems.

HILCO Hyflow Oil Filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, and keeps your hydraulic system clean and in top running condition at all times. To you, this means longer oil life, reduced wear and abrasion . . . hence, less down time and lower maintenance costs giving you continuous equipment operation with increased production. Hydraulic unit sensitivity depends upon a clean system. HILCO Hyflow filters remove solids as soon as they enter the system and retain much of the moisture which enters the oil from the atmosphere and from condensation. Obtain the full capacity and economy of your equipment by keeping it in top running condition with HILCO. Hydraulic Oil Filters come in stationary or portable models. They can be hooked into hydraulic systems without interrupting equipment operation.



HILCO
OIL RECLAIMER

For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gasses, etc., from hydraulic fluids by heat-vacuum process.

• SEE FOR YOURSELF HOW HILCO keeps your Hydraulic System Clean . .

WRITE TODAY FOR THIS *Free* BOOKLET

Recommendations at no Obligation

THE HILLIARD *Corporation*

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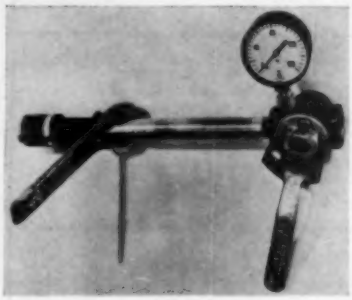
IN CANADA:

BRIEFS continued

Electric Company, eliminates the welding operation. A test plug is inserted at each end of the pipe



and after pressure has built up within the pipe, a small lubricated plug valve assures a leak-proof seal. If there is a leak in a joint or somewhere within the pipe, pressure loss is indicated on the gauge. ▼▼▼

Mohamed And The Mountain

Faced with the problem of how to give customers and prospects in-action demonstrations of their products, Howell Electric Motors Company has introduced its Motormobile.

Designed around the theme "ideas in action", this laboratory on wheels will bring the company's

story right to the door of the customer's plant. Motors are shown operating under full load along with graphic demonstrations of construction features developed to give design and plant engineers new concepts of motor application and selection. Gear motors, torque motors, brake motors and disc motors are among the displayed units, and a lighted panel of installation photographs show manufacturers who utilize the firm's motors for power.

This Motormobile will eventually reach all marketing areas in the United States. ▼▼▼

Continued on page 32

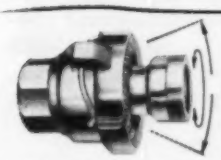
BARCO

The Only Complete Line of

BALL • REVOLVING
SWIVEL • SWING

JOINTS

WHEREVER PIPING CONNECTIONS MUST MOVE, look to BARCO for the ANSWER! Whatever your problem, Barco, invariably, can solve it BETTER, EASIER, and QUICKER with a tested and proven joint right out of the standard Barco line. This is because Barco builds a truly complete line of flexible ball, swivel, swing, and revolving joints — *there is a size and type for every purpose!* Submit your problem; ask for recommendations — Barco is at your service.



Flexible

BALL JOINTS

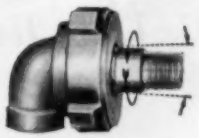
for Angular Flexing and Swivel or Twisting Movement

This is a versatile, general purpose design suitable for many applications. Standard the world over where low cost, leakproof, movable joints are needed in piping handling steam, air, water, oil, gas, or chemicals. One joint will frequently serve the same purpose as several one-plane swing joints. Up to 40° side flexibility *plus* 360° swivel action facilitates quick connection of piping, overcomes misalignment. Pressures to 4,500 psi; temperatures to 1,000°F. 12 styles, sizes from ¼" to 12".

Self-Aligning

SWIVEL JOINTS

for Swivel Motion or Slow Rotation

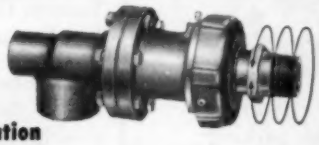


Specially designed for and widely used in making compact, low torque connections to reciprocating or hinged parts on molding presses, construction machinery, die casting machines, oil burners. Barco's *self-aligning* feature provides side-flexibility (up to 10°) which speeds up installation and prevents binding. Easy to position piping accurately—no sagging, flopping lines. Leakproof, pressure safe. Ratings as high as 600°F., 3,000 psi (hydraulic). Sizes, ⅜" to 2"; angle or straight.

Leakproof

REVOLVING JOINTS

for Continuous Rotation



Barco design insures trouble-free performance, minimum roll drag, and up to 50% power savings. Inherent low torque is little affected by increasing pressure, speed, or temperature. Parts are easily accessible. Light running action minimizes wear, permits free-floating installations. No adjusting necessary — long, leakproof service. Ratings to 250 psi (steam); 450°F. Single flow or syphon styles. Sizes ½" to 2" and special to 5". Wide choice of styles.

High Pressure Hydraulic

SWIVEL JOINTS

for Aircraft, Ordnance, and Industrial Service

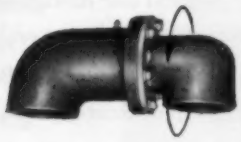
Especially designed for high pressure hydraulic or pneumatic use with flared tubing or small piping. Flexibility in joint absorbs vibration, compensates for misalignment, eliminates binding, minimizes wear, simplifies and speeds up installation. Choice of styles; sizes ¼", ⅜", ½", ⅝". Corrosive resistant construction for service to 3,000 psi, —100°F. to 500°F. Approved for many military and aircraft applications. Plane swivel designs also available.

High Speed

REVOLVING JOINTS

for Clutches, Chucks and Machine Tools

¼" Type NV. Used in making high speed, leakproof rotary connections for pneumatic, hydraulic, or coolant lines. Light running, sealed ball bearing design handles both radial and end thrust with low torque and minimum wear. Easy to install where space is limited; economical. Precision built for rugged service. For speeds to 2,500 RPM; other designs for up to 10,000 RPM.



"Controlled Torque"

SWING JOINTS

for Loading Racks, Fueling Assemblies

Built to support piping and provide for swing movement in handling gasoline, oil, alcohol, and other fluids. Special ball bearing, long sleeve design with exclusive "controlled torque" action permits uniform, easy movement, but prevents annoying uncontrolled swinging. Single swing, double swing, and counterbalance styles with counterweights to meet every need. In steel and malleable iron or Bar-Ductile metal, sizes 2", 2½", 3", 4", 6" and 10". Also in complete loading line assemblies.

SEND FOR INFORMATION

BARCO MANUFACTURING CO.
5321 Hough Street, Barrington, Illinois

Gentlemen:
Please send me information about Barco Products checked at right:

Name_____

Company_____

Address_____

- ☐ BALL JOINTS. Catalog 215A.
- ☐ SWIVEL JOINTS. Catalog 265A.
- ☐ SWIVEL JOINTS (Tubing Type) Catalog 269.
- ☐ REVOLVING JOINTS. Catalog 300A.
- ☐ TYPE NV REVOLVING JOINTS. Catalog 307.
- ☐ SWING JOINTS. Catalog 400.
- ☐ INSULATING (Electrolytic) JOINTS for Piping.
- ☐ FLEXIBLE STRUT JOINTS for structural uses.

Fast change-overs are easy on the new

NP Power Drive Cylinder

This cylinder has *all* the *most wanted* design features . . . provides exceptional adaptability, quick assembly and disassembly. You can make *many* fast change-overs using the simplest tools. Cushioning is easily adjusted; packing and internal parts can be changed; operation modifications can be made quickly on the *basic* cylinder.

No other cylinder offers so many vital features: compact, streamlined design; lightweight aluminum alloy and steel construction with *no* sacrifice of strength; sealed-in lubrication which eliminates need for external line lubricators. Operates with air, water or oil without interchanging or adding parts.

RATINGS: air — 200 psi; water or oil — 500 psi; Bore diameters: 1½″, 2¼″, 3″, 4″. Mountings: foot, flange, pivot, clevis, trunnion

NATIONAL PNEUMATIC CO., INC. AND **HOLTZER-CABOT** DIVISIONS

125 Amory St., Boston 19, Mass.
Sales Service Representatives in Principal Cities throughout the World

Designers and manufacturers of mechanical, pneumatic, hydraulic, electric and electronic equipment and systems

Mail this coupon today for data sheets illustrating many other features

INDUSTRIAL ACTUATORS AND CONTROLS DIVISION
NATIONAL PNEUMATIC CO., INC.
125 Amory Street, Boston 19, Massachusetts

Gentlemen: Please send me design information on the NP Power Drive Cylinder . . . Include information on NP Power Check feed control — NP Power Trol valves —

Name.....

Title.....

Company.....

Street.....

City..... *Zone*. ....*State*.....

BRIEFS / continued

FUTURE EVENTS

October 11-15: Golden Anniversary Aeronautic Meeting. Aeronautic Production Forum and Aircraft Engineering Display. Hotel Statler, Los Angeles, California.

October 24-26: American Standards Association and National Bureau of Standards. Sixth Annual Conference on Standards. Sheraton Park Hotel, Washington, D. C.

October 24-28: The Canadian Tool and Equipment Show. The Show Mart, Montreal, Canada.

October 25: "Servomechanisms—as applied to large machinery" is subject to be discussed by James Robinson, chief engineer of Vickers, Inc. ASME Evening Meeting, Engineers Club, Philadelphia.

October 27-28: The Eleventh National Conference on Industrial Hydraulics. La Salle Hotel, Chicago, Illinois.

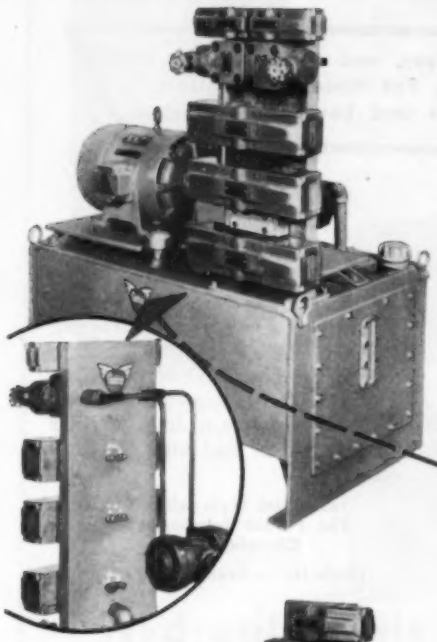
November 2-3: Fifth Transport Aircraft Hydraulic Conference, Park Sheraton Hotel, Detroit, Michigan. Under the sponsorship of Vickers Incorporated, attendance is by invitation only. Co-chairmen of the meetings will be N. S. Smith, engineering superintendent, Pan American World Airways Miami Overhaul Base, and A. C. Ford, superintendent of engineering, Delta C & S Air Lines.

November 2-4: Fall Meeting of the National Fluid Power Association. Edgewater Beach Hotel, Chicago, Illinois.

November 14-18: Chicago Exposition of Power and Mechanical Engineering. Chicago Coliseum, Chicago, Illinois.

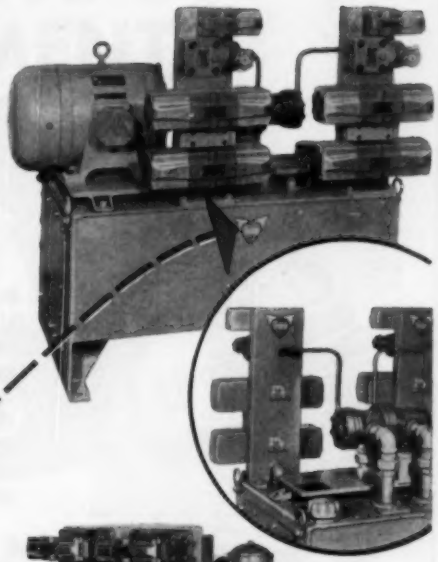
December 12-16: Nuclear Engineering and Science Congress. Cleveland, Ohio. Sponsored by the Engineers Joint Council. Tentative program covers the advances in more than fifty fields of atom engineering and science. ▼▼▼

CENTURY HYDRAULIC UNITS . .
The Heart of Great Automation Jobs!



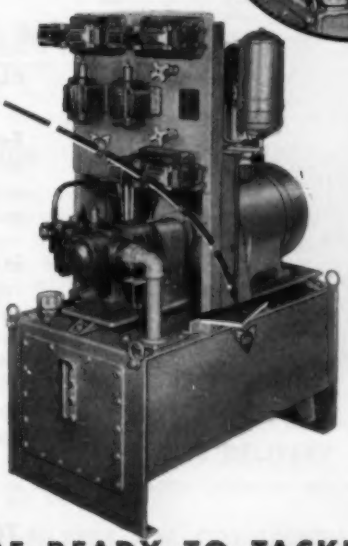
Compact Package Units

Manifold mounted, if desired, to eliminate excessive piping and possibility of leaks at each joint, assuring virtually no down-time . . . Stand-by valves can be replaced in minutes.



Century HYDRAULICS DETROIT, MICH

THE TRADE MARK OF UNEXCELLED QUALITY AND DEPENDABILITY IN HYDRAULICS



OUR DESIGN AND BUILD FACILITIES ARE READY TO TACKLE YOUR PROBLEM—NOW!

We carry a stock of reservoirs and other components to facilitate speed of delivery on custom jobs.

Special rotary motion hydraulic actuated devices for turn-over stations are available.

CALL, WIRE, WRITE TO-DAY!!!

Century HYDRAULICS DETROIT, MICH.

CENTURY HYDRAULICS, INC.

8866 GREENFIELD • DETROIT 28, MICHIGAN

Circle 31 on Reader Service Card

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

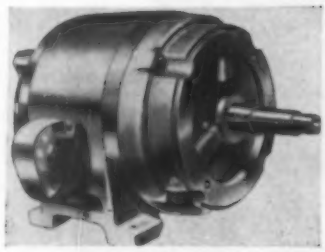
ACCUMULATORS
. . . and pre-charging accessories

Features: Accumulators are available in 11 sizes ranging in capacity from 10 to 1155 cu. in. Rated working pressure is 3000 psi. The design of these accumulators makes them highly suitable for storing energy, absorbing shock and supplementing pump capacity. The new precharging accessories include gages, adapter, gaging device, hose, and charging assembly.

Design: Temperature operating range is —40 F to 200 F. Shell is tubular steel with ID of 1½, 4, or 7 inches. End caps are forged steel with three wrench lugs. O-rings seal hydraulic fluid and gas pressure.

Industrial Hydraulics Div.
The Parker Appliance Co.
Cleveland, Ohio

Circle 160 on Reader Service Card



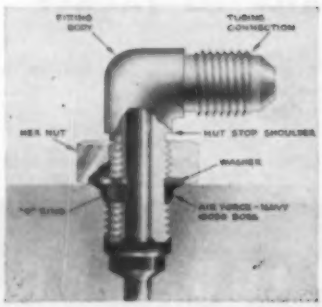
ELECTRIC MOTOR
. . . for pump mounting

Features: Motor has face-type registered bracket and special shaft suitable for close-coupled centrifugal pump applications. Pump may be mounted flush with motor by bolting to face bracket. This ensures accurate alignment of pump and motor. To prevent water from entering motor, a solid flange and brass slinger are incorporated. Shaft is stepped with special diameters, and has shoulder and tapped hole for mounting the impeller. Shaft diameters are precision ground to very close tolerances for accurate assembly and sealing against leakage. Motors are available in ratings from 1 to 30 hp.

Design: Motor castings are normalized for permanent accuracy. Windings are asbestos-protected. Split-type conduit box can be rotated in 90-degree steps and located on either side of the motor. Rotors are electronically balanced and solid cast.

U. S. Electrical Motors, Inc.
Los Angeles, California

Circle 161 on Reader Service Card



TUBE FITTING
. . . replaces thread sealing

Designation: Ring Seal

Design: Fitting has O-ring and washer between two thread sets. Upward travel of O-ring, washer and hex nut is limited by special shoulder in fitting body. On installation, when O-ring engages boss, fitting is turned to extrude the O-ring into the cavity between the boss and the fitting body. The position of the washer below the nut prevents damage to the O-ring from contact with the threads.

Specifications: Fittings are available with 45-degree, 90-degree, male outlet tee, and male run tee bodies. These are in sizes to fit ¼, 5/16, ⅜, ½, ⅝, ¾, and 1-inch tubing. Fittings can be directionalized with ease in any material and require approximately the same installation space as previous designs.

Monarch Machine Tool Co.
Sidney, Ohio

Circle 162 on Reader Service Card

Continued on page 37

SUMP TYPE (Cutaway)

For Dependable Protection on HYDRAULIC EQUIPMENT

MARVEL SYNCLINAL FILTERS

LINE TYPE (Cutaway)

Hydraulic Oils MUST BE CLEAN!

to Protect Equipment—
Increase Production—
Reduce Maintenance

PRODUCTION ENGINEERS and MAINTENANCE MEN, whose job it is to keep production machinery operating at peak efficiency, are specifying Marvel Synclinal on new equipment and standardizing with Marvels throughout their plants.

OVER 600 ORIGINAL EQUIPMENT MANUFACTURERS of hydraulically actuated equipment or machines utilizing low pressure liquid circulating systems, also recognize the superiority of Marvel Synclinal Filters in serving this purpose and are installing them as standard equipment.

It's The ACTIVE Filtering Area That Counts!

The Synclinal design of Marvel Filters provides that all-important balance between maximum ACTIVE filtering area and sufficient storage capacity for filtered out particles. Thus, longer periods of productive operation are attained before filter cleaning is necessary. Marvel Synclinal Filters are easy to clean because both the sump and line type may be disassembled, thoroughly cleaned and reassembled in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

IMMEDIATE DELIVERY

As in the past, MARVEL continues to offer IMMEDIATE DELIVERY.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

Catalogs containing complete data available on request

MARVEL ENGINEERING CO.
7227 N. HAMLIN AVE., CHICAGO 45, ILL.
PHONE: JUniper 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters as follows:

Catalog No. 176 for Hydraulic Oils, Coolants, Lubricants — AH-10
Catalog No. 300 for Water
Data on filters for fire-resistant hydraulic fluids

Name ..... Title .....

Company .....

Address .....

City ..... State .....

Here's why the IPC "Bond" stays . . . stuck

It's more than a sticking process! IPC in laboratory preparation has discovered a special bonding agent which, under proper molding, causes an affinity between rubber and metal.

IPC bonded case seals and bonded washers can be submitted to the most grueling strain. *The bond between metal and rubber will not break down.*

This absolute adhesion is your protection against packing failure. Your problem can be solved by IPC's "custom bond." Write for details, today.

INTERNATIONAL PACKINGS CORPORATION

Bristol, New Hampshire

Branch Offices: Chicago, Dallas, Detroit, Kansas City, New York, Philadelphia, San Francisco, St. Louis.

BONDED BY IPC

1. Bonded Washer Seal Double Lip Wiper
2. Bonded Case Seal Double Lip Wiper
3. Bonded Washer Seal Straight Lip
4. Bonded Washer Seal Limited Contact Lip
5. Bonded Washer Seal Straight Lip With Garter Spring
6. Bonded Washer Seal Limited Contact Lip With Garter Spring
7. Bonded Case Seal Straight Lip
8. Bonded Case Seal Limited Contact Lip
9. Bonded Case Seal Straight Lip With Garter Spring
10. Bonded Case Seal Limited Contact Lip With Garter Spring
11. Bonded Case Seal Straight Lip Thin Rind Type
12. Bonded Case Seal Limited Contact Lip Thin Rind Type
13. Rubber Covered Bonded Case Seal Straight Lip
14. Rubber Covered Bonded Case Seal Limited Contact Lip
15. Rubber Covered Bonded Case Seal Straight Lip With Garter Spring
16. Rubber Covered Bonded Case Seal Limited Contact Lip With Garter Spring

P6

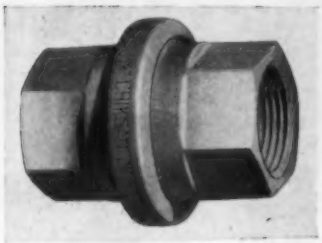
New Products / continued

SWIVEL JOINT
. . . at low cost

Designation: Junior Joint #1

Features: Swivel joint prevents hose kinking and increases hose life. Permanent clamp design is for use on air, hydraulic, and other lines where free swiveling action is required.

Construction: Unit is cast from Zamak #5 an alloy with excellent



resistance to corrosion, and combining strength and retention of dimensions under impact. O-rings are synthetic to handle soluble oils, water, air, etc. Special O-rings are available for synthetic hydraulic fluids. Clamps are cadmium-plated steel for rust resistance.

Chiksan Company
Brea, California

Circle 163 on Reader Service Card

AIR SEPARATOR
. . . has no filter element

Designation: Textite

Features: Separator effectively cleans air of water, oil, dirt,

scale, cinders, and other elements. Through a unique arrangement of cleaning elements, this separator re-

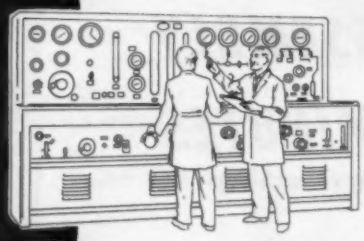
Continued on page 42

The Better TEST MACHINES Bear this Trade Mark

When you see the "SPRAGUE" Trade Mark on a test machine, you can be sure of accuracy, efficiency, economy and years of dependable service.

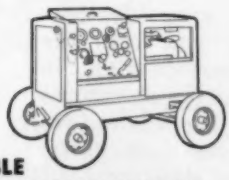
SPRAGUE ENGINEERING CORPORATION GARDENA, CALIF.

In addition to the machines shown here, SPRAGUE makes Fuel Flow and Fuel Pump Test Stands, Heating and Ventilating Test Units, High Pressure Hose Testers, Air Operated Hydraulic Boost Pumps, Filters, Cylinder type Accumulaters (3,000 and 6,000 psi.), Gage Protector Automatic Shut Off Valves and other equipment. Write for information.



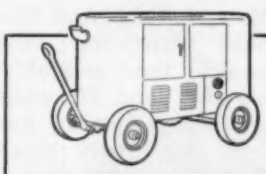
STATIONARY HYDRAULIC TEST STANDS

Tests aircraft hydraulic components, including engine driven pumps, at operating pressures up to 5000 psi. and with flows to 20 gpm. Provides multiple circuits to permit simultaneous testing of several units.



PORTABLE HYDRAULIC TEST STANDS

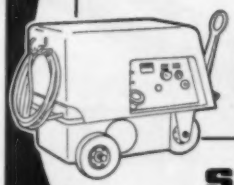
Standard units, 10 G.P.M. to 40 G.P.M. Motor or engine driven. For complete testing of aircraft hydraulic systems.



PRESSURIZED CABIN LEAKAGE TESTERS

Supply clean, filtered air under controlled pressure to locate leaks and determine leakage rate.

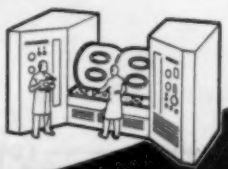
AIR OPERATED OIL DISPENSERS



Dispense clean, filtered oil simply, quickly, economically. One-man operation. Maximum safety.

FUEL BOOST PUMP TEST STANDS

Designed especially to test submerged fuel boost pumps. Tests both A.C. and D.C. types.

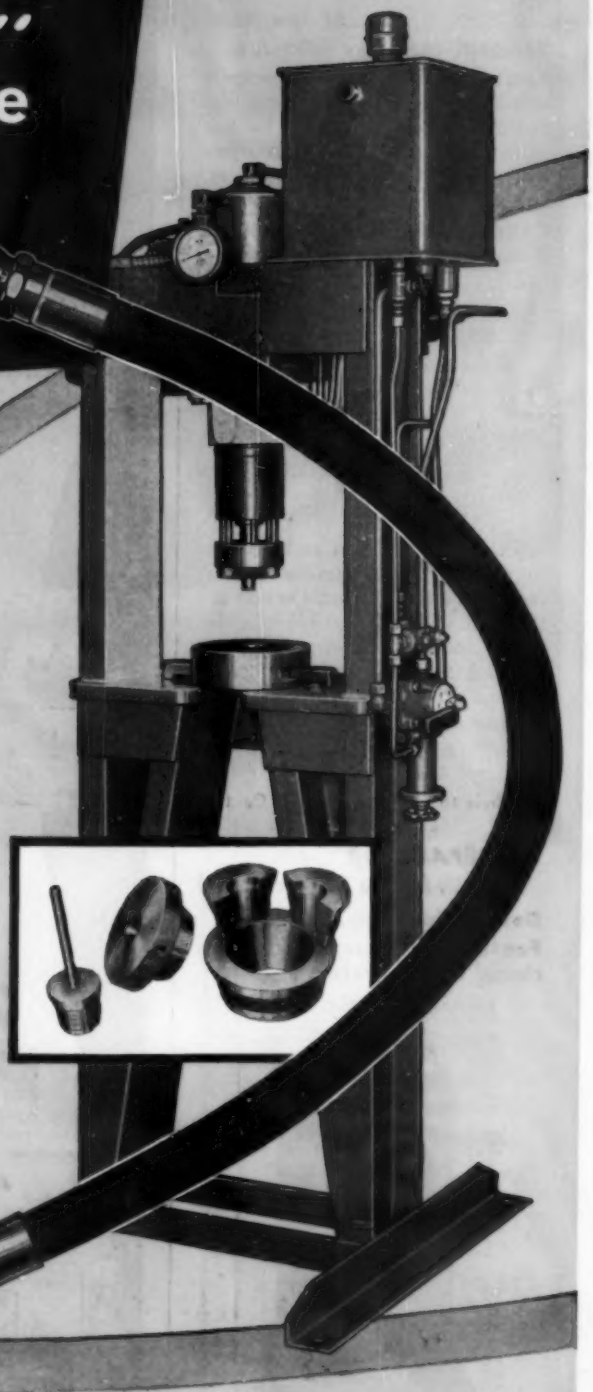


SPRAGUE
Engineering Corporation
1144 W. 135th Street
Gardena, California

Circle 123 on Reader Service Card

right now...

Swaged Hose Assembly Service



....AT YOUR WEATHERHEAD

DISTRIBUTOR

ANY HOSE ASSEMBLY MADE IN 3 MINUTES

Right In His Own Service Shop

Now, for the first time, your Weatherhead distributor offers you complete swaged hose assembly service right in his own shop. No waiting for shipments of factory-finished hose assemblies. No need for costly downtime and delay. Equipped with the new Weatherhead swaging press and the complete line of Weatherhead hydraulic hose and hose ends, your distributor is prepared to supply you with any size, type and length hose assembly at once.

Wherever you are, whatever your need, there is a Weatherhead distributor strategically located to give you immediate stand-by swaged hose assembly service.

WEATHERHEAD LEADS THE WAY

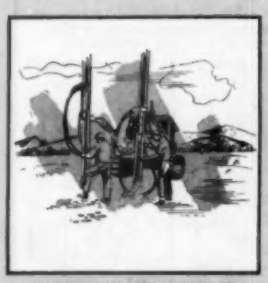
now available

at Weatherhead Distributors

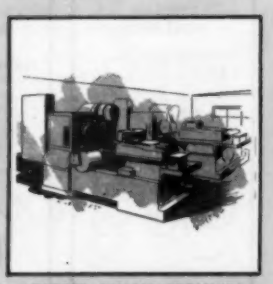
ON-THE-SPOT SWAGING SERVICE FOR HYDRAULIC HOSE ASSEMBLIES

Any Size . . . Any Type . . . Any Length . . .

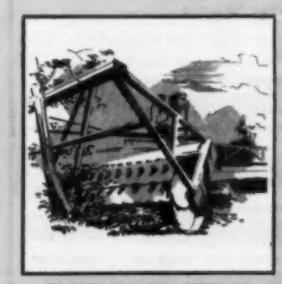
The complete range of sizes from ¼" to 2" I.D. in the Weatherhead full line of hose and hose ends, eliminates any delay in completing the job. Be assured of safe, trouble-free service by specifying Weatherhead for all your hose assembly needs. The Weatherhead complete line of fittings and hose is as near as your phone. Call your local Weatherhead distributor today for immediate service.



RIGHT AWAY SERVICE
For mining and oil drilling fields.



RIGHT AWAY SERVICE
For all types of manufacturing operations.



RIGHT AWAY SERVICE
For construction and farm machinery.

RIGHT AWAY SERVICE
For hydraulic materials handling equipment.

Turn the page

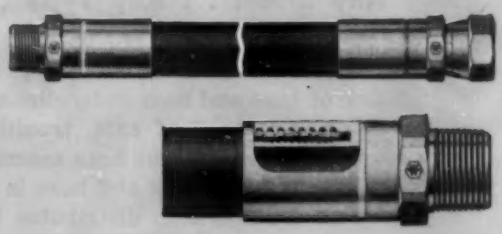
WEATHERHEAD

WEATHERHEAD DISTRIBUTORS

Your reliable source for "RIGHT-NOW" Hose Assembly Service

Weatherhead swaged hose assemblies match factory-made assemblies in every respect. They are available in any quantity, length, type or size to meet your needs. Now made-to-order hose assemblies are available at once through your local Weatherhead distributor at no additional cost. Your downtime is cut to a matter of minutes because your order can be made up on Weatherhead swaging equipment right in your Weatherhead distributors own service shop.

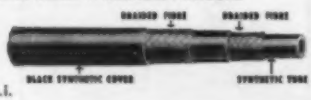
Take advantage of your Weatherhead distributor's dependable RIGHT-NOW hose assembly service. Save money. Reduce downtime.



TYPES OF HOSE

H-17 TWO FIBRE BRAID ● MEDIUM PRESSURE

sizes: ¼" to 1" I.D.
working pressures: 550 to 1250 p.s.i.



H-104 ONE WIRE BRAID ● MEDIUM PRESSURE

sizes: ¼" to 1" I.D.
working pressures: 1250 to 2500 p.s.i.

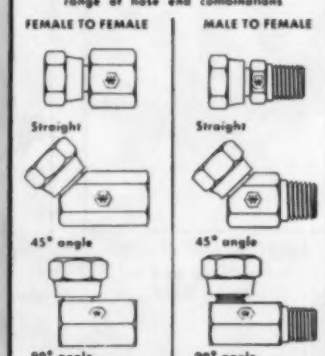
H-425 TWO WIRE BRAID ● HIGH PRESSURE

sizes: ¼" to 2" I.D.
working pressures: 1250 to 4500 p.s.i.

TYPES OF HOSE ENDS

SWIVEL ADAPTERS

These swivel adapters permit a wide range of hose end combinations



WEATHERHEAD LEADS THE WAY

WEATHERHEAD... your only complete "single-source" Hydraulic Hose and Fitting Line ...FIRST IN COMPONENTS FOR HYDRAULIC SYSTEMS

An INDUSTRIAL HOSE for every need — low, medium-high and high-pressure applications; in complete size ranges to 2" I.D.; suited for any service condition.

REUSABLE HOSE ENDS for fast assembly and positive, leak-proof connections. Rugged construction that cuts costs through repeated use. Designed to insure maximum flow.

ERMETO® reusable hose ends for connecting hose assemblies directly to block or manifold are also available from stock in standard sizes. Specified by major diesel manufacturers for high-pressure fuel injection lines.

Only Weatherhead gives you hose ends with extra-long gripping area for dependable performance under high pressures.

ERMETO® fittings in steel and stainless steel for leakproof seals without flaring, threading or welding. Withstand shock loads, vibration and impulse at highest pressures. Ermeto connections can be uncoupled and reassembled time after time.

37° FLARED STEEL FITTINGS conform fully to J.I.C. standards. Available in all types and sizes with tube or dry seal pipe thread outlet.

BRASS FITTINGS—S.A.E. 45° flare, compression, inverted flare, double compression (threaded sleeve), are machined from extruded stock, giving strength equal to forgings. Large, flat wrench pads provide easy gripping for fast assembly, even in hard-to-reach places.

There's an experienced Weatherhead field engineer ready whenever you need him to help you take full advantage of all that Weatherhead offers.

THE WEATHERHEAD CO., FORT WAYNE DIVISION
DEPT. A-10 , 128 WEST WASHINGTON
FORT WAYNE, INDIANA

SEND FOR FULL DETAILS TODAY!

The Weatherhead Co., Fort Wayne Division
128 West Washington, Fort Wayne, Indiana
Send full details on your Distributor's stand-by swaged hose assembly service.

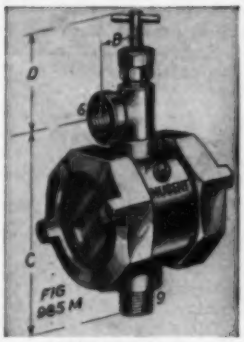
Company_____
Address_____
Your Name_____

Circle 143 on Reader Service Card

DESIGN AUTOMATIC POSITIVE LUBRICATION INTO YOUR PRODUCTS with NUGENT LUBRICATING SPECIALTIES

SIGHT FEED VALVES

Sight Feed Valves provide a means of regulating and visually checking oil flow at the point of delivery to bearings, gears, etc. By regulating the Sight Feed Valve, oil flow is controllable from 2 drops per minute up to 21 U.S. gallons per hour. The oil stream through the valve is visible at all times through a removable, dust-proof sight glass. Sizes ¼" to ¾" i.p.s. for working pressures to 125 p.s.i.



Sight Feed Valve

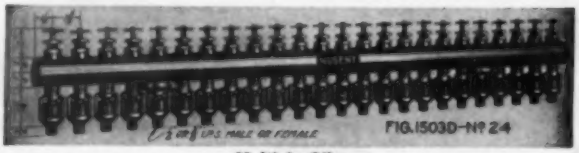
SIGHT FLOW INDICATORS

With a Nugent Sight Flow Indicator installed in your lubrication system, you can tell at a glance whether or not oil is flowing properly to vital parts. The Sight Flow Indicator can also be wired with an alarm bell to sound in any desired location—enables you to correct troubles quickly and protect valuable equipment. Windows are removable for cleaning. Sizes ½" to 6".

Sight Flow Indicator

MULTIPLE OILERS

Nugent Multiple Oilers are designed for lubricating enclosed bearings and other hard-to-get-at spots. Oil from a pump or reservoir is piped to the oiler and fed to the bearings by means of tubing through independently adjustable needle valves.
Available in a variety of types with any number of feeds.
In addition to lubrication specialties, Nugent offers a complete line of lubrication devices and oil filters. Write for descriptive literature, mentioning the type of equipment you are interested in.



Multiple Oiler

Wm. W. Nugent & Co., Inc.
421 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Established 1897

Representatives in Boston • Cincinnati • Dorval • Houston • La Jolla, Calif. • Los Angeles • Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco • Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

New Products continued

moves unwanted by-products of compressed air without the aid of moving parts to wear, or filter elements to clean or replace. Only the air stream moves throughout the unit where centrifugal action, jetting, sudden expansion, capillary attraction, and scrubbing actions are used to remove the contaminants.

Chicago Manufacturing & Distributing Co.
Chicago, Illinois
Circel 164 on Reader Service Card

AIR SHUT OFF-VALVE
. . . is compact and rugged

Designation: HV-250
Features: Valve can be used as normally off or normally on. Holes are bored to provide horizontal or vertical mounting, or unit can be

mounted with a pipe nipple only. Valve is designed for pressures up to 150 psi and special construction permits passage of 52 cfm at 100 psi. The unit is especially applicable to multiple air set-ups. Valve is available in ¼-inch size and will soon be made in ⅛ and ⅜-inch sizes.

Power-All Products
Oakland, California
Circle 165 on Reader Service Card

ELECTRONIC TIMER
. . . has 2% accuracy

Designation: Model 2 Type CK
Features: Timer has built-in voltage regulator that overcomes the effect of line voltage variations. Timed interval varies less than 2%

Continued on page 45

IT'S A MATTER OF PRINCIPLE!

For over 35 years the name LASSMAN has been associated with the finest in industrial hydraulic equipment . . . from individual components like valves and cylinders to packaged pumping units, presses and complete hydraulic systems. The scope of our work has also involved special or "off-standard" equipment and quite frequently the "hard-to-do" jobs. Behind all these activities have been certain motivating principles which we feel will be of interest to you.

When we are making up an estimate for a given application, we offer only what we feel will do the job intended in the best way possible, and we design and build the equipment accordingly. We do not believe in substitutes or half-way measures just for the sake of making a sale. "Quality Equipment for Quality Performance" is more than just a slogan . . . it is a sound business principle which assures us satisfied customers.

It is our further contention that hydraulic equipment cannot always be sold on the basis of catalog information only. For example, to sell a cylinder based on bore, rod diameter, stroke, assumed pressure . . . and price . . . can mean that the customer is also buying trouble, for a cylinder which works well in one application may fail in another. LASSMAN engineering, however, assures you of the proper components or a complete system to provide trouble-free operation.

We do not believe in designing "to the limit" merely for the sake of saving on the initial investment at the expense of performance. Such designing places a premium on the ultimate rating of the equipment. In contrast, all LASSMAN equipment can be operated at full rated load continuously without breakdown or loss of efficiency.

Then there are the twin items of maintenance and ease of maintenance. To us, these mean no maintenance over a long period of time, and our experience shows a very successful record in this respect.

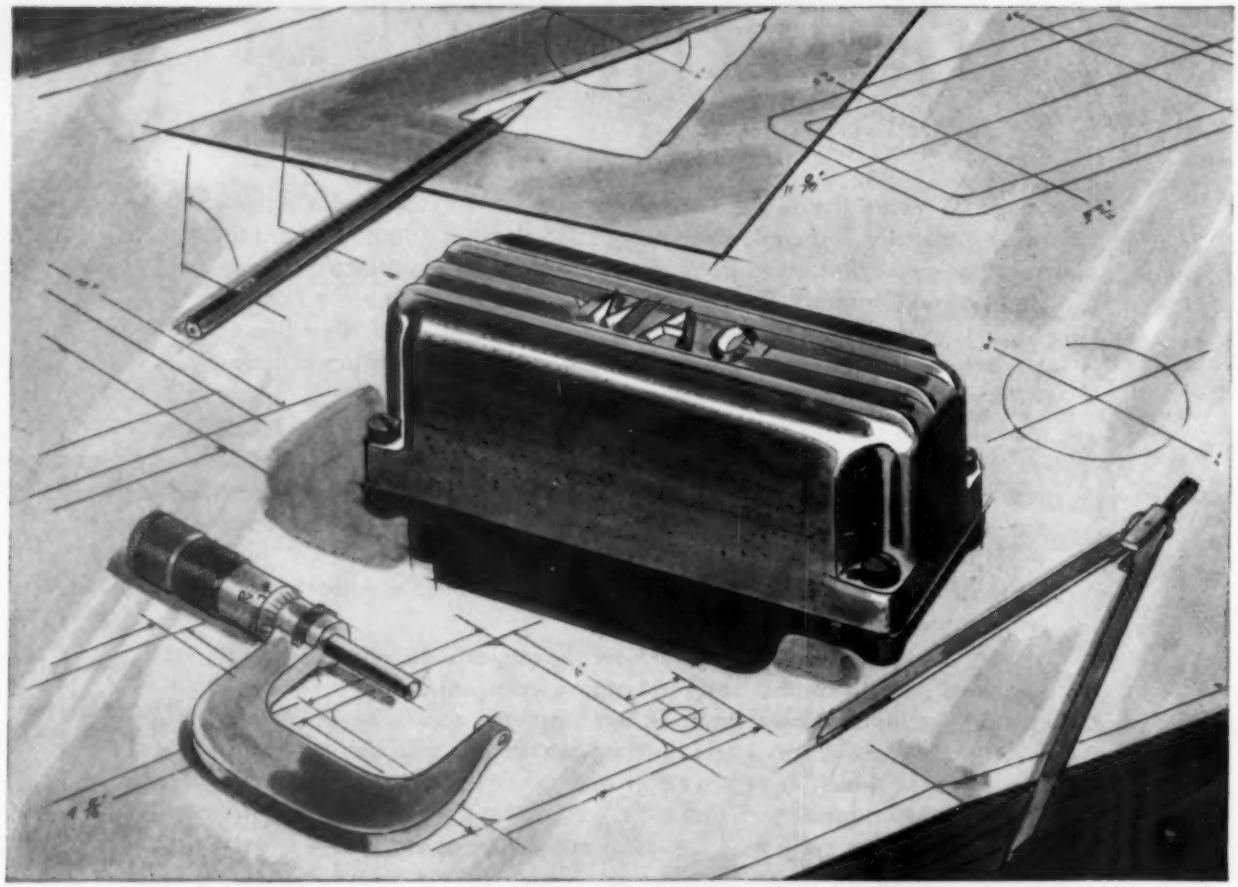
We even back this up with a TWO YEAR GUARANTEE against defects of material and workmanship.

And so we say, **it's a matter of principle.** Let us show you how LASSMAN quality hydraulic equipment, engineering and design can provide the ultimate in uninterrupted, reliable performance.

Quality EQUIPMENT for *Quality* PERFORMANCE

BENJAMIN LASSMAN & SON Route 8, GLENSHAW, PA.

WELL CALIBRATED TO KEEP YOU IN OPERATION!



You've seen it happen. An air valve fails—a key piece of equipment goes down—production grinds to a halt. Time, quotas and money are lost, never to be recovered.

But here at MAC we take the downtime out of valves before they leave the plant. Here, where we believe air valves are made more carefully and expertly than anywhere else, every spool, every spring, every solenoid is checked and rechecked. Every valve is tested and retested under conditions as rugged as we can make them. And every valve is *right*, or it doesn't get shipped. Add to this the fact that MAC valves pace the industry for simple, sound design and you'll have an inkling of why MAC has earned a reputation for long, dependable operation for millions of maintenance-free cycles . . . why MAC is well calibrated to keep you operating.

Test a MAC valve in your plant. We have 92 sizes and types—one for virtually any application. Phone a MAC representative, at right, or send for free literature.

MECHANICAL AIR CONTROLS, INC.
10030 Capital, Oak Park, Detroit 37, Michigan

MAC

PHONE YOUR NEARBY "MAC" REPRESENTATIVE FOR DATA AND DELIVERY

CALIFORNIA
OAKLAND 8—The Rucker Co., 4700 San Pablo Ave., OLympic 3-5221
SOUTH GATE—The Rucker Co., 4956 Firestone Blvd., KImball 8271

ILLINOIS
CHICAGO 43—Mike C. Modrich & Co., 10336 South Western Ave., Hilltop 5-3640

INDIANA
FORT WAYNE 3—Neff Engineering Co., P. O. Box 2001, Station A, 2339 Crescent Ave., EAstbrook 7391
INDIANAPOLIS 20—Neff Engineering Co., P.O. Box 7361, 42nd St. Station, BRoadway 2330
SOUTH BEND—Dick Futter, 103 South Varsity Dr., 2-4856

MARYLAND
BALTIMORE 6—Grand Air-Hydro Division, K. William Ostrom & Co., Inc., 6105 Alta Ave., HAmilton 6-6669

MASSACHUSETTS
BOSTON 34—Electrical Apparatus Co., Inc., 1200 Soldiers Field Rd., STadium 2-7440

MICHIGAN
BAY CITY—Fred Kober, 506 Chilson St., 2-2629
FLINT—Kober Sales Engineering Co., 514 Beach St., CEdar 8-5123
GRAND RAPIDS—Kober Sales Engineering Co., 190 Monroe Ave., GLendale 4-3252

MINNESOTA
MINNEAPOLIS 4—Air Engineering & Supply Co., 2445 Nicollet Ave., FIlmore 5579
ST. PAUL 14—W. H. Schulz Co., 2438 Franklin Ave., Midway 2744

MISSOURI
ST. LOUIS COUNTY—Oscar E. Jost Co., P. O. Box 162, St. Ann, HArrison 8-4488

NEW YORK
BUFFALO 21—C. H. Topas Co., 200 Washington Hwy., CIrcle 3210

OHIO
CINCINNATI—The R. W. Nichols Co., Fidelity Federal Savings Bldg., 2087-9 Sherman Ave., Norwood, ELmhurst 2440
DAYTON—The R. W. Nichols Co., 407 Realty Bldg., Michigan 4724
OLMSTED FALLS—The R. W. Nichols Co., P. O. Box 6, BEres 4-1379
TOLEDO 4—The R. W. Nichols Co., 510 Manhattan Bldg., MAin 8623
YOUNGSTOWN 3—The R. W. Nichols Co., 202 Schwenn-Wagner Bldg., Riverside 4-4550

OREGON
PORTLAND—The Rucker Co., 911 N. W. Hoyt St., BEacon 0205

PENNSYLVANIA
PHILADELPHIA 4—Grand Air-Hydro Div., K. Wm. Ostrom & Co., Inc., 3717 Filbert St., EVergreen 2-5444
PITTSBURGH 22—The R. W. Nichols Co., 101 Investment Bldg., ATlantic 1-6050

TEXAS
DALLAS 19—Womack Machine Supply Co., 6409 Maple Ave., DIxon 6997

WASHINGTON
SEATTLE—The Rucker Co., 101 Jones Bldg., Rm 203, MAin 2783

WISCONSIN
MILWAUKEE 10—Neff Engineering Co., 2837 North 50th St., Hilltop 5-3340

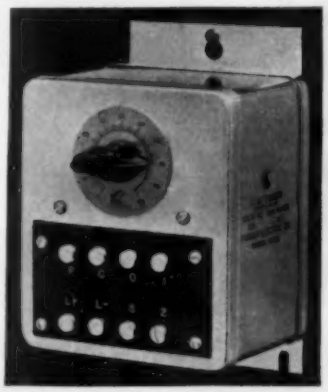
CANADA
ONTARIO, HAMILTON—Higginson Engineering Sales, P. O. Box 23 (275 James, North), JAckson 9-2262

MECHANICAL AIR CONTROLS, INC.
DETROIT 37, MICHIGAN
MAC

New Products continued

of full scale for any line voltage change between 95 and 125 volts. General purpose unit has single-pole, double-throw load contacts independent of the timing circuit. A modification of this unit provides momentary-contact start, self-recycle, non-repeat, with load circuit non-isolated from control circuit.

Specifications: Timers are available in full-scale ranges of .2, .5,

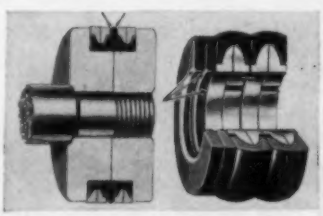


1.5, 3, 6, 12, 24, or 60 seconds. A variable control with 0-100 graduated dial permits setting intervals down to .03 seconds for each range. Unit incorporates cold-cathode tube requiring no warm-up time and draws current only while timing. Relay contacts are rated 8 amperes at 115 volts ac.

Farmer Electric Products Co., Inc.
Waban, Massachusetts
Circle 166 on Reader Service Card

PISTON PACKING
. . . has new chamfer

Designation: Monopak
Features: New chamfer on flat



rings eliminates ring extrusion and resultant braking action under heavy pressure. In addition to a more frictionless sealing action, this design change provides an efficient trap for any minute foreign matter that might escape the rod cleaning device.

Hydraulic Accessories Co.
Van Dyke, Michigan
Circle 167 on Reader Service Card

ROTARY SOLENOID
. . . for a-c operation

Features: Solenoid produces pure rotary movement at the shaft and simplifies application by eliminating the need for counter balancing the spiral action of some rotary devices. Torque developed by the solenoid provides all the desirable force characteristics of conventional linear solenoids, but permits easy installation without levers and linkages.

Design: Unit is essentially a toroidal coil system wound on a stator,

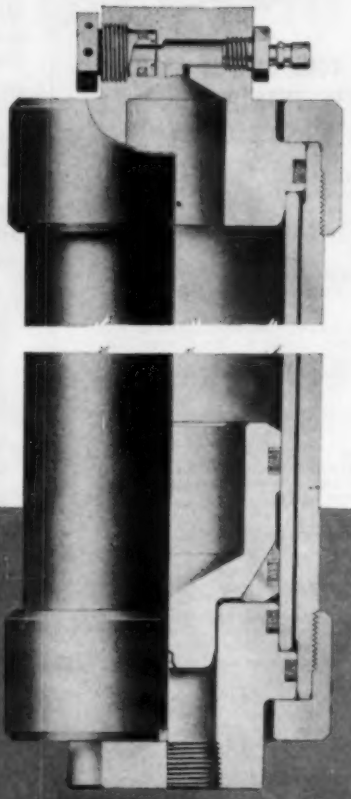
and a shaft mounted rotor. When energized, the magnetic field causes the rotor and shaft to turn. Because of this rotary design, the solenoid is unaffected by vibration and shock and operates in any mounting position.

Specifications: Eight basic sizes provide torques from fractional inch-pounds to 62.5 inch-pounds at maximum stroke on continuous duty models. Stock models give 20, 30, and 45 degrees of rotation. Rotations to 60 degrees are available. Solenoid is rated at 115 volts, 60 cycles.

Leotronics
Division of Lee Spring Co.
Brooklyn, N. Y.
Circle 168 on Reader Service Card

For more NEW PRODUCT reviews turn to page 146

The FIRST and MOST ADVANCED Separator Type Accumulators Ever Developed To Offer These Outstanding Design Features



Superior Accumulators

■ SUPERIOR ACCUMULATORS — First with a safety fuse that releases gas when it exceeds manufacturer's specifications, to prevent damage to equipment and injury to personnel.

■ SUPERIOR ACCUMULATORS — First with a double shell body for safe heavy duty service.

■ SUPERIOR ACCUMULATORS — First efficient industrial accumulators with low pressure drop.

■ SUPERIOR ACCUMULATORS — First accumulator designed that permits mounting in any position, simplifying system design and installation.

■ SUPERIOR ACCUMULATORS — First to incorporate a dashpot design that decelerates piston travel and eliminates damaging effect of piston shock loads and hammering.

■ Superior Accumulators are now produced to 5,000 P.S.I. max working pressure, from 5 to 21,950 cu. in. net gas volume and from 3 to 5,560 cu. in. max oil working volume.

Standard single shell accumulators and intensifiers are also available or special units can be developed to meet your specifications.

Write or call for more detailed information and prices.

Superior Hydraulics Division

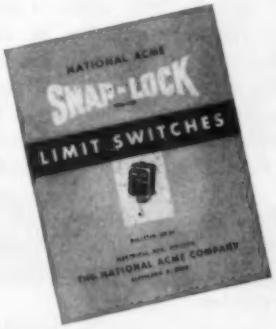
15201 ST. CLAIR AVE. • CLEVELAND 10, OHIO

DIVISION OF SUPERIOR PIPE SPECIALTIES CO. • 2917 S. Cicero Ave. • Cicero 50, Ill.

Circle 131 on Reader Service Card

more than 15,000,000 contacts without a care for repairs...

here's the limit switch that spells electrical control dependability in any language



Send for Bulletin EM-51 which shows various types of Snap-Lock Limit Switches available, design features, specifications, wiring diagrams, ordering data—and other National Acme electrical components and controls.

Proven stamina under all kinds of operating requirements (some installations requiring more than 400 contacts per minute) has made National Acme SNAP-LOCK Limit Switches a top-heavy favorite with both design and production engineers.

Mechanical simplicity and ruggedness are the reasons why Snap-Locks have proven an outstanding success in thousands of heavy duty equipment installations. The record shows that in many such cases, they have stood up under more than 15,000,000 contacts.

Built in a variety of sizes and designs including water resistant and special purpose types.

Ask us to assist you in designing these trouble-free switches into your equipment

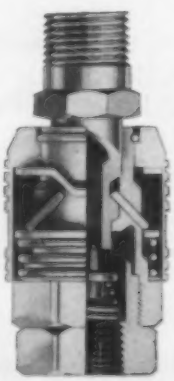
ELECTRICAL MANUFACTURING DIVISION

The NATIONAL ACME COMPANY

156 EAST 131st STREET • CLEVELAND 8, OHIO

NEW "HI-LO" SPEED COUPLERS and CONNECTORS

(HIGH VOLUME — LOW PRESSURE DROP)



"HI-LO" for *highest* air volume, *lowest* pressure drop

Better efficiency, lower operating costs for all air-operated devices.

Easy to use—snap on and off.

Swivel action saves wear on hose.

Wide selection of sizes for greater range of uses.

Leak-proof seal.

Interchangeable with many other brands of couplers and connectors.

Write for bulletin No. 5518T.

THE ARO EQUIPMENT CORPORATION
Bryan and Cleveland, Ohio

Aro Equipment of California, Los Angeles, Calif., Aro Equipment of Canada, Ltd., Toronto 15, Ontario.

Offices in All Principal Cities

ARO®
SPEED COUPLERS
Also Air Tools... Air Hoists... Lubricating Equipment . . . Aircraft Products . . . Grease Fittings

LETTERS
to the editor

Wants Servo Components

We would like to have names of suppliers for: 1. A proportional type electrically actuated hydraulic 4-way valve for guided missile servo system application. Pressure and flow requirements are 3000 psi and 5 cu in per second. Space limitations require a very small valve. 2. A small hydraulic pump suitable for missile application. Flow to approximately .5 gpm, speed 12000 rpm. If the speed is not this high, then we would consider gearing to bring the input shaft to this speed. Oil pressure is up to 3000 psi.

M. LAM
Engineering Department
Canadian Westinghouse Co. Ltd.
Hamilton, Ont.

Names of possible suppliers have been forwarded to you. You'll probably need at least a 4:1 *gear ratio for the pump.*

Fluid Line Sizes

Many thanks to Allan Morris for his fine article on "Fluid Line Sizes" in the August issue. It may be the answer to many of our problems involving overheated hydraulic systems. May I call your attention to what I believe to be an error in table 1 of this article. The final column has obviously been calculated for the cross-sectional area of the piston rod itself, instead of the differential area between the piston rod and the cylinder.

ALLEN BRADRICK
Chief Methods Engineer
McQuay-Norris
Manufacturing Co.
St. Louis, Mo.

In table 1 *we made an error in heading the last column. As Mr. Bradrick points out, this column should be called "gallons displaced by the rod". Having this informa-*

Continued on page 52

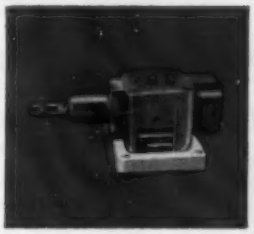
Double A's WIDE LINE OF HYDRAULIC CONTROL VALVES

Offers you...

EXACT VALVE ACTION REQUIRED WITH FEWER VALVES AT LOWER COST

- ★ PIPE SIZES: ¼" THRU 2"
- ★ OPERATING PRESSURES: MODELS FOR 2000 P.S.I.–3000 P.S.I.–5000 P.S.I.
- ★ MOUNTING TYPES: CONNECTIONS IN BODY, SUB-PLATE MOUNTING, FLANGED CONNECTIONS

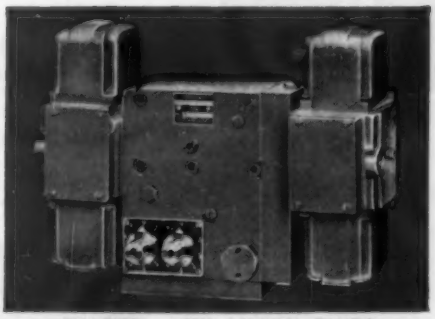
RELIEF VALVES



BY-PASS VALVES (for sequence and unloading applications)

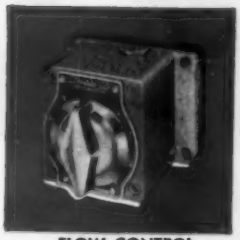
BY-PASS and CHECK VALVES (for counterbalance and sequence applications)

REDUCING VALVES



TRAVERSE and FEED CONTROL PANELS

REDUCING and CHECK VALVES



FLOW CONTROL VALVES

DIRECT SOLENOID VALVES

SOLENOID CONTROLLED PILOT OPERATED VALVES

WRITE FOR NEW FULL LINE CATALOG
OR CONTACT YOUR LOCAL REPRESENTATIVE

Double A PRODUCTS CO.
MANCHESTER, MICHIGAN

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R. C. Neal Co., Inc.
Buffalo-Mohawk 1110
Elmira Heights-5168
Rochester-Glenwood 9390
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Hydraulic Power Equipment Co.
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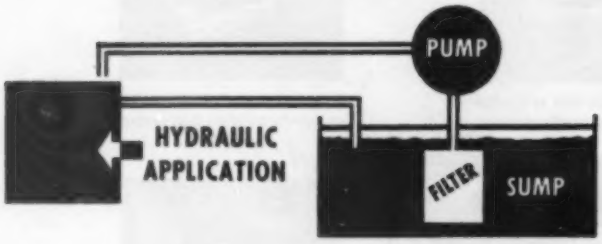
OUTSIDE CONTINENTAL U. S. CONTACT
International Sales Division
New York Airbrake Company
New York, New York
Phone: Worth 4-3580

STAYNEW HYDRAULIC FILTERS

HELP PREVENT ABRASIVE ACTION

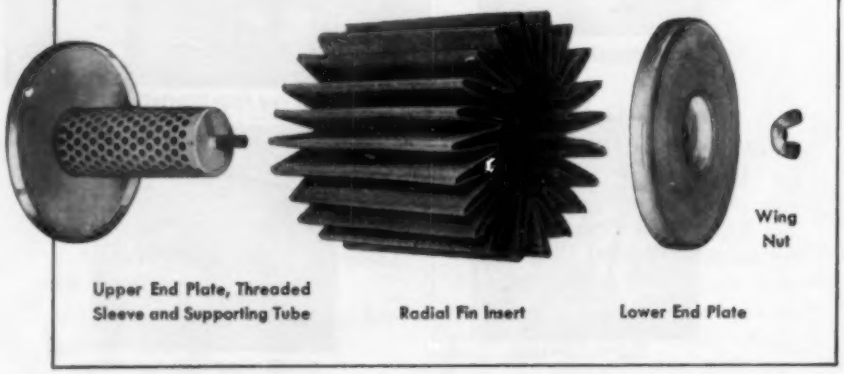
SAVE 3 WAYS WITH *STAYNEW FILTERS* ON YOUR HYDRAULIC EQUIPMENT



The Staynew HE Hydraulic Filter is a compact, simplified, efficient unit for use wherever dirty liquids are collected, filtered and re-circulated. Its unique radial fin design permits the largest possible active filtering area in the smallest possible space . . . and actually saves three ways:

1. Saves unnecessary wear on costly pumps and other equipment by preventing intake of abrasive particles.
2. Saves spoilage and rejects at point of use by insuring clean, clear liquid.
3. Saves man-hours wasted while new machines are being installed or old ones repaired.

MODEL HE
Hydraulic Filter



Entire unit may be disassembled in 30 seconds merely by unscrewing wing nut at bottom and drawing out Radial Fin Insert. *Insert may be cleaned with solvent or brush in a matter of seconds.* It is not necessary to remove the filter from the line to take out the Insert.

Send your filtration problems to Staynew. Models available for complete range of sizes and capacities at low cost. Write for Bulletin HF-2 today.

Representatives in Principal Cities

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

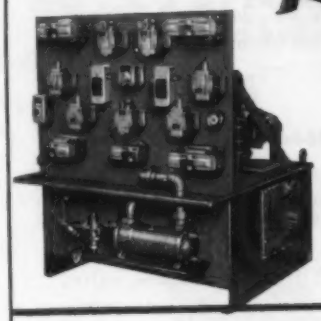
DOLLINGER

CORPORATION

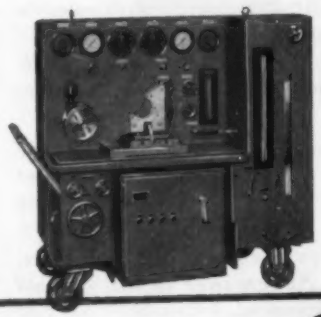
65 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Pulpit type power unit provides full visibility, easy accessibility.



Compact power unit showing gasket-mounted valves.



Portable power unit for testing pumps.

Power unit with gasoline engine as prime mover.

Power unit for hydraulic control of electric furnace.

6837

Individually Designed to Meet *SPECIFIC* Needs

VICKERS®
Custom Built
HYDRAULIC POWER UNITS

DEPENDABLE PERFORMANCE

IMPROVE AND SIMPLIFY DESIGN

REDUCE INSTALLATION COST AND TIME

EASIER SERVICING

BETTER APPEARANCE

Vickers engineers approach the design of a custom-built hydraulic power unit from the standpoint of the customer's INDIVIDUAL needs. The sole objective is to meet HIS requirements with the best hydraulic "package". This assures the most compact, efficient and convenient hydraulic equipment for the particular machine.

A Vickers Hydraulic Power Unit includes all necessary pumps, valves, intermediate piping, oil reservoir, motors, controls, etc., as well as all hydraulic accessories (oil filters, air cleaners, oil level gauges, fittings, etc.). Hydraulic connections can be grouped in a convenient manifold.

In addition to the advantages mentioned above, each Unit is pretested at the factory and ready for immediate operation. Vickers undivided responsibility for the entire hydraulic control system is also an important feature to both the machine builder and his customer. Write for Bulletin 52-45.

VICKERS INCORPORATED
Division of Sperry-Rand Corporation
1474 OAKMAN BLVD • DETROIT 32, MICH.

Application Engineering Offices: • ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N. J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA • WASHINGTON • WORCESTER

IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

★ *SINCE 1926* ★ *in the application, design & mfg. of pumps — separators — hydraulic accessories.*

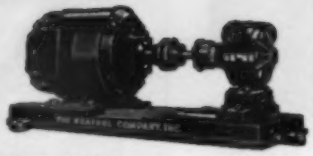
KRAISSL

EQUIPMENT FOR FLUID POWER TRANSMISSION

Primary Oil Pumps

Class 50 Pumps

Direct connected oil pumps for general pressure circulation of oil. High suction lift; pressures up to 100 psi.
Ask for Bulletin A-1330



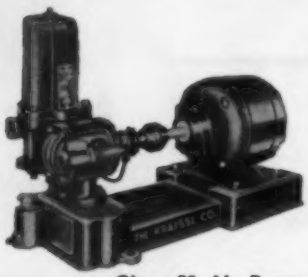
Class 60M Pumps

Designed for general industrial oil supply. Direct-connected for light oils, reduction-drive for heavy oils. Capacities to 200 gpm.
Ask for Bulletin A-1267

Vacuum-Powered Transmission and Low-Pressure Air Service

Class 21 & 25 Air Pumps

Oil lubricated pumps —vacuums up to 28" mercury; wide range pressures.
Ask for Bulletin A-1289



Class 23 Air Pumps

Designed for mechanical suction and pressure requirements for the printing and packaging machinery fields.
Ask for Bulletin A-1399

Air Filters

Class 26 Air Filters

Originally designed as integral part of Kraissl oil-lubricated air pumps—now available for independent applications; remove all oil vapors and pipe condensates in compressed air lines.
Ask for Bulletin A-1184

Class 72A Dust Separators

Mounted at vacuum pump intake, minimizes entry of dust, shavings, extraneous matter. Saves its cost in maintenance time. Sizes ⅜" to 2½".
Ask for Bulletin A-1409

Class 72 Separators

Remove extraneous matter from hydraulic circulation lines. Single and duplex strainers and filters—for both standard and high pressure installations. Sizes ¼" to 6".
Ask for Bulletins 1430-1431-1214

KRAISSL KRAISSL CO. Inc.

305 Williams Ave., Hackensack, N. J.

LETTERS to the editor

tion, simple calculation of gallons displaced by the differential area can be made for any combination of bore and piston rod noted in the table. Therefore, the column of figures is o.k., but the heading to the column should be changed.

Handbook on Hydraulics

We are looking for a textbook on the subject of mechanical hydraulics. By this, we mean the art of transmitting power through the use of oil pumps, cylinders, valves and motors. Please do not confuse this with the subject dealing with handling water as hydro-electric plants, etc. Also, do not confuse it with the use of hydraulics in machinery such as fluid couplings and torque converters.

R. C. SHOEMAKER
Supervising Engineer
Hyster Company
Portland, Ore.

You've come to the right place, Mr. Shoemaker. What you call "mechanical hydraulics" is our field. We've sent you a copy of our Data List which is a bibliography of books in the field. Look for the coming January issue. It will contain a complete index to all material published in the field during the last 25 years.

Special Valve

Can you supply us with information about a valve which permits free flow in either direction at normal velocity and working pressure, but acts to cut off flow from the cylinder if the line should break.

ARNOLD W. DUARTE
The Rucker Company
Oakland 8, Calif.

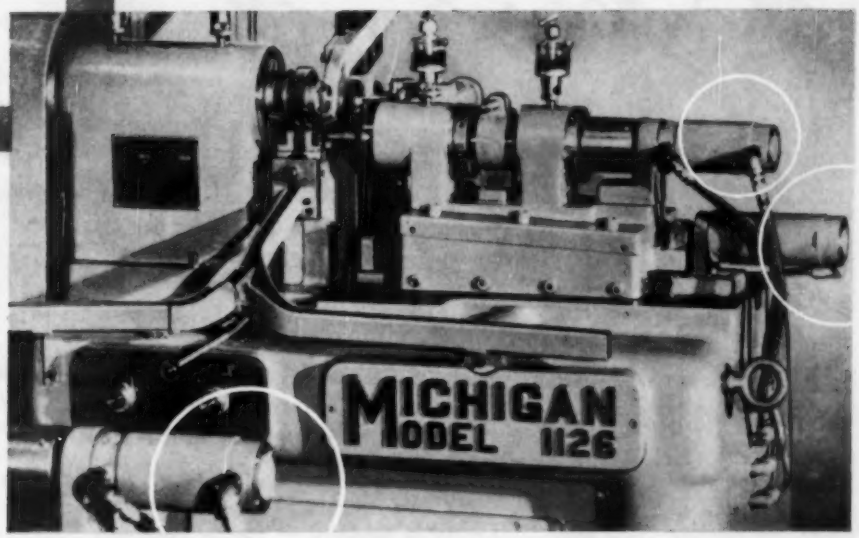
On lift trucks, often a flow regulator mounted close to the cylinder serves this purpose. If there should be a break in lines to the cylinder, the flow regulator prevents rapid dropping of the load.

Continued on page 54

O-M

CYLINDERS
(air and hydraulic)

an important part of the automation picture at MICHIGAN TOOL COMPANY

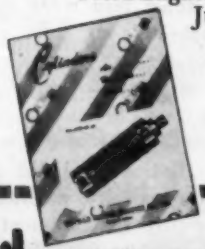


O-M cylinders (shown here installed on an automated speeder) are an integral part of "Gear-O-Mation" at Michigan Tool Company. In their automatic gear production line, O-M cylinders provide the muscle in the movement or holding of parts.

Important factors in Michigan Tool's choice of O-M cylinders for these machines were: *COMPACTNESS OF DESIGN* – their cleaner, more streamlined construction that allows installation in less space; *LESS MAINTENANCE* – easier to clean, inspect, remove, dis-assemble and service, if necessary, with no special equipment or skills needed. Knocks out downtime, keeps loading equipment in continuous operation.

O-M air and hydraulic cylinders are available in complete range of sizes (1½ to 8" bores), with standard, 2 to 1 or oversize rods. All steel construction with bearing bronze. Completely interchangeable parts. Immediate delivery on many sizes.

Whatever your particular straight-line motion applications may be, an O-M Field Engineer will be happy to call and discuss them with you. Just mail coupon . . . no obligation, of course.



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for FREE catalog, showing all cylinders, mounts and mounting brackets.

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Manufacturing facilities are keyed to precise production control. This means you can depend on Flex-O-Tube delivery dates . . . and that's mighty important when you're working against tight production schedules.

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Dependable, too, is the engineering counsel we gladly extend when you're developing new flexible hose products. This engineering know-how is based on more than twenty years in the business.

If there's a flexible line in your product to conduct air or liquid, that has to be bendable, call in Flex-O-Tube . . . it's dependable.

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Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

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Flex-O-Tube Co. (Canada) Ltd., Windsor, Ontario

LETTERS to the editor

A hydraulic fuse would perform the function you describe. Information about fuses has been sent to you.

Needle Valve

We are working on a hydraulic circuit in which a ¼" needle valve is needed. The valve must be solenoid operated, suitable for oil pressures to 2,000 psi, for operation with 110 volts, 60 cycle, AC current. Flow must be handled in either direction with high pressure on either side.

H. M. SHNEIDER
Sonntag Scientific Corp.
Greenwich, Conn.

To our knowledge this is not a standard valve with any manufacturer. Several valve manufacturers who may be able to provide this valve have been suggested. Readers may also have some suggestions for a source.

Wants Bibliography on Servos

I am attempting to build a library on the subject of servovalves and hydraulic servosystems. Can you help me?

AARON BAUMGARTON
Walter Kidde Nuclear Laboratories Co.
Garden City, N. Y.

You'll find the coming January issue very valuable. This issue will include a complete index to all published material in the hydraulic and pneumatics field during the last 25 years. This index will be broken down into more than 50 categories—one of them will be hydraulic servosystems.

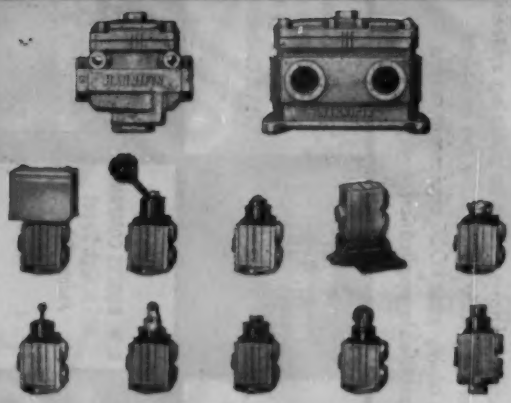
Pump Design

It is desired to build a very small, low capacity, medium pressure, positive displacement pump for low viscosity fluid. We are inclined to turn to the rotary, positive displacement pump such as the gear pump. We should like to obtain a source of information on

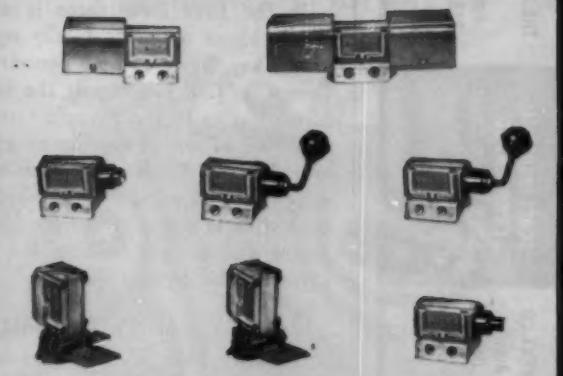
Continued on page 56

FOR AIR CYLINDER CONTROL... Manual or Electric

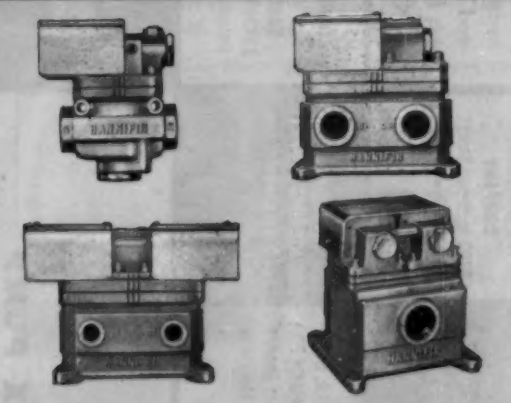
Hannifin Disc Valves. 3-way and 4-way, direct- or pilot-operated. For hand, foot or electric actuation.



Hannifin P-M Master Valves. 2-way, 3-way, 4-way. Remotely controlled from wide choice of Pilot Valves.



Hannifin P-M Direct-Operated 4-Way Valves. Small, compact, inexpensive. For every type operation.



Hannifin P-M Pilot-Master Valves. Solenoid controlled by integral pilot heads. 2-way, 3-way and 4-way.

HANNIFIN has the Air Control Valves for Your Specific Applications

Hannifin has the air control valves you need for use on your production lines or on the products you manufacture, often in a choice of types.

Shown here are typical valves from the extensive and complete Hannifin line. There's a Hannifin valve for every use from the simplest to the most complicated air-operated circuit. Singly or in combination, Hannifin valves provide hand, foot, cam, pressure or solenoid operation . . . in almost every pipe size.

You can simplify your air control valve problems by standardizing on Hannifin. Call in your Hannifin representative, who will discuss your valve requirements. Meanwhile, write for our complete Control Valves catalog.

WRITE FOR BULLETIN

Your copy of the complete Hannifin Control Valves catalog will be sent on request.

Stock Delivery on all types!

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Air and Hydraulic Cylinders • Pneumatic and Hydraulic Presses • Riveters • Air Control Valves

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KOBE HAS... Coast to Coast Distribution
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Your local KOBE distributor knows hydraulics, knows hydraulic application, knows hydraulic pumping systems—and is chosen for his ability to engineer the complete job for you. His ability plus KOBE equipment means a better, more profitable application, every time.
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H. U. ROGNESS, INC.
135 S. 11th Street
Minneapolis 3, Minn.
KOBE
815 Superior Avenue
Cleveland 14, Ohio

LETTERS to the editor

clearances, capacities, life and noise. What type of pump has the longest life? Our requirement is quite small—only .05 to .1 gpm.

WILLIAM FRY
Oak Ridge, Tenn.

Your delivery requirements are way below any standard available pump. Sources of data on pumps have been forwarded.

Large Pneumatic Valves

In the June issue there is an article about a pneumatically operated key driver at Erie Foundry Company. Can you supply the information as to the manufacturer and size of the 4-way hand operated valve? We have a pneumatically operated wood splitter which is similar in operation to the key driver and we are looking for a valve similar to that described in your brief.

D. B. DENOYER
Valley Iron Works Company
Appleton, Wis.

The 4-way manually operated valve used on the pneumatically operated key driver is a special valve. The size of the equipment on this machine is 2½ inches.

20,000 psi Pump

In increasing the range of our pressure calibrating cabinet, we have been searching for a good source to 20,000 psi. Can you suggest manufacturers of compact motor driven units capable of developing such pressures?

L. D. GILMORE
Product Development Engineer
International Harvester Co.
Melrose Park, Illinois

We don't know of any small motor driven unit which is capable of developing this high pressure without the use of an intensifier. If you need a small package, a study should be made of available boosters.

Connect up with L and L

The Complete Line of Steel Fluid Power Couplings

JIC Flare Tube — Pipe Threaded
Flare Tube — Straight Thread "O" Ring
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C—Needle Valve
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E—Flange Manifold
F—Straight Thread, "O" Ring Seal Fitting
G—Ball Check Valve
H—Lateral Outlet Fitting
I—Universal Elbow
J—Dryseal Pipe Fitting
K—Hex Reducing Bushing
L—Swivel Elbow
M—Barbed Hose Stem

You can depend on L & L's quality, availability, and selection of steel couplings for piping all industrial hydraulic circuits.

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the new L and L . . .

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straight thread fitting

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- Fits two types of straight thread ports, L & L type and AND–10050 port. AND–10050 port requires "O" ring seal. L & L port can be sealed with or without "O" ring.
- Eliminates stress—elbows and tees can be positioned without overtorque of threads.
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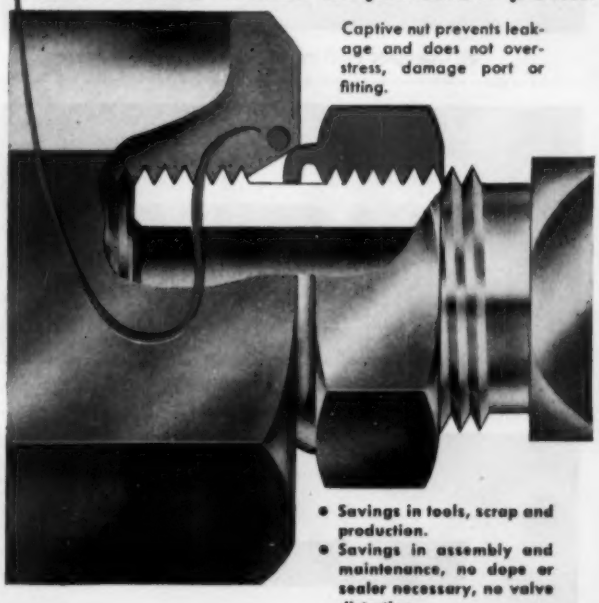
- Assemble and reassemble without damage to port or fitting—assures positive seal.

Eliminates leaks at junction point.

Captive nut prevents leakage and does not overstress, damage port or fitting.



- **Savings in tools, scrap and production.**
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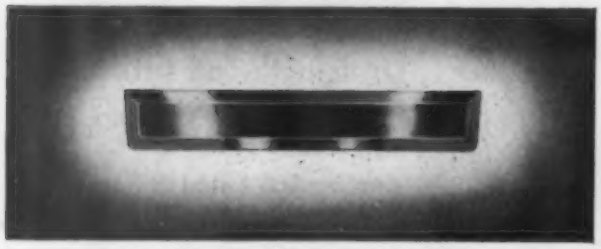
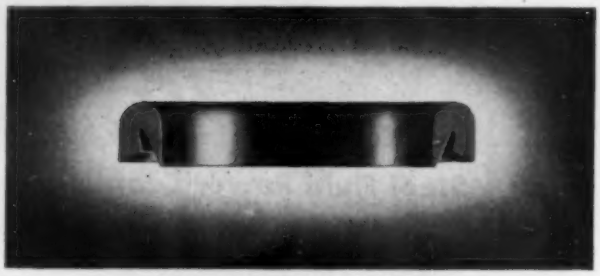
Only L & L gives you a "Complete Fitting Line"

Simplify your sealing problems...

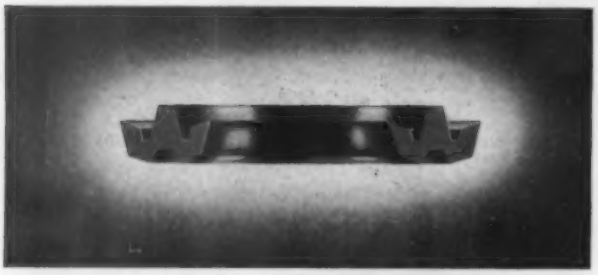
with Johns-Manville Precision moulded packing designs for pressure applications in hydraulic and pneumatic equipment



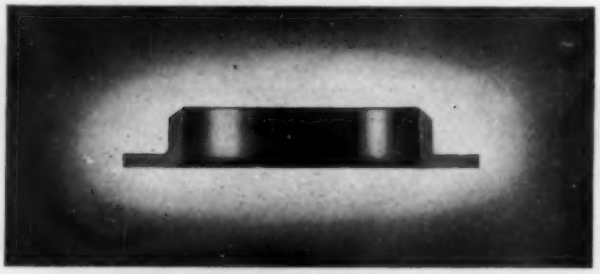
1. Type "A" Packing Cups for pistons *(the original "square heel" cup design)*



2. Sea Ring packing for rods

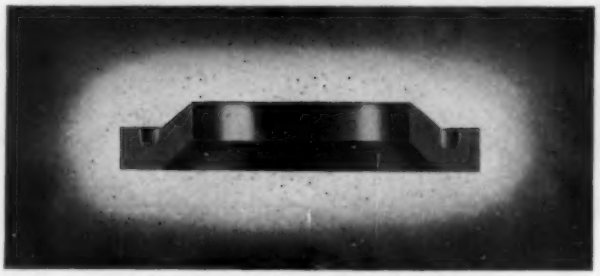


3. Uneepac Packing for rods and pistons



4. Hat Cup Packing for rods

5. V-Rings packing for rods and pistons



6. Cumpac #239 packing for rods

7. U-Cup Packing for rods and pistons

THE WIDE VARIETY of Johns-Manville Packing designs enables you to handle practically any sealing problem. The designs shown on this page are obtainable in a broad range of standard sizes and in materials designed for either usual or special service conditions encountered in hydraulic and pneumatic equipment. Johns-Manville also produces oil seals, moulded gaskets and miscellaneous shapes to specification. See your local J-M distributor or J-M sales office for product or engineering data. Or write Johns-Manville, Box 60, New York 16, N.Y. In Canada, Port Credit, Ontario.

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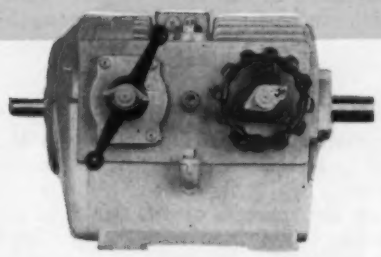
Johns-Manville MOULDED PACKINGS

Highest Torque at Low Speeds...



. . . no oversize power plant needed with the

new GEROTOR VARIABLE SPEED HYDRAULIC TRANSMISSION.

Here's the variable speed transmission that gives you HIGHEST TORQUE

in LOW SPEED RANGE. Find out about this and all of the other exclusive

features offered by GEROTOR in this new transmission. *Write . . . TODAY!*

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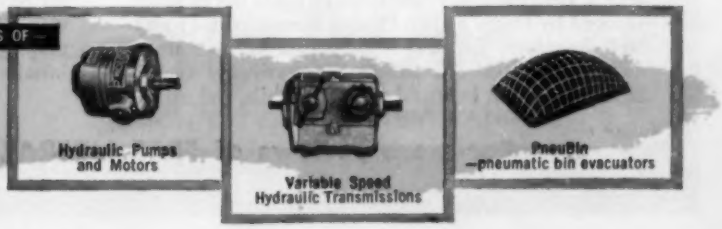


Useful Literature

For your free copy of publications reviewed, fill in the reader service card

TUBING . . . with various cross sections including squares rectangles, ovals, ellipticals, and partial rounds are described in Data Memorandum No. 17 from Superior Tube Co. Shapes of mechanical tubing for bushings, punches and machine parts are illustrated. The memorandum gives complete information on analyses available including stainless, carbon, nickel and nickel alloys, glass sealing alloys, titanium, and berylium copper. Other information includes tool charges, size range, commercial tolerances, lengths, temper, and how to order.

Circle 210 on Reader Service Card

BOOTS & SLEEVES . . . produced from a neoprene material are discussed in Bulletin SPC-2 available from A & A Manufacturing Co., Inc. Fourteen different designs for sleeves, boots, way protectors and related pliable parts are illustrated. All designs are fabricated to order and there are no manufacturing restrictions on sizes, shapes, or contours. Rounds, squares, and rectangular shapes are shown in use in angular, horizontal, and vertical positions. Weights of materials, as fabricated into a single design may range from .023 to .050 inch in thickness to serve operating cycles where movements shift rapidly through more than one plane. Water-tight zippers can be provided to facilitate installation and removal of the boot.

Circle 211 on Reader Service Card

HYDRAULIC CYLINDERS . . . are featured in a brochure prepared by Benton Harbor Engineering Works, Inc. Construction and design of the company's cylinders are pictured to illustrate accurately honed barrels, hard chrome-plated rods, small OD and variety of mountings. Many applications of these cylinders are shown. Also included is a cutaway photograph of a flow control valve for installation on lift trucks to eliminate surges as the load starts down, and to control heavy load descent.

Circle 212 on Reader Service Card

LIMIT SWITCHES . . . A new line of completely sealed, environment-proof limit switches has been developed by Micro Switch Div. of Minneapolis-Honeywell Regulator Co. and is presented in preliminary data sheet P103. The subminiature switches are designed for use in industral aircraft, mobile, and marine applications where environmental conditions are severe. In addition to being sealed, the new switches contain an inert gas, to eliminate effects of atmospheric changes or severe environmental conditions. The switches are lightweight and offer a variety of electrical rating and circuitry selections. The data sheet shows dimensions and gives electrical ratings.

Circle 213 on Reader Service Card

PRESSURE SNUBBER . . . now available in stainless steel is specified in Catalog File 1191A11 available from The Parker Appliance Co. The unit protects sensitive gauges from sudden pressure changes, and eliminates wild fluctuation of the gauge pointer permitting more accurate readings. The unit is T-shape permitting adjustment through the side chamber without disturbing line connections. Three pins used in various combinations offer 13 gradations of damping adjustment. Rated working pressure is 5000 psi.

Circle 214 on Reader Service Card

AIR FILTERS . . . for dehydration and filtration of compressed air are described in Bulletin M-7155 published by Hankison Corp. The units designated Condensifilters deliver instrument quality air. They clean and dry compressed air by the use of an internal condenser in combination with a disposable filter cartridge in a heavy-gage steel casing. A moisture-vapor content chart which enables evaluation of the water vapor in an air system is also included in the bulletin.

Circle 215 on Reader Service Card

HYDRAULIC VALVES . . . Double A products Co. has issued Catalog No. 551 covering their complete line of valves. The catalog contains complete specifications on relief valves, bypass valves, flow control valves, and others. A chart is included to show the JIC symbol for each valve type according to the catalog designation. Charts are included for various valve types to show pipe size, rated flow capacity, JIC symbol, and action as the spool is shifted. Oil-pilot and air-pilot valves are specified, as well as manually operated valves and solenoid-controlled, pilot-operated valves. The catalog is profusely illustrated with photographs, and JIC symbols are used to illustrate typical installations.

Circle 216 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 154

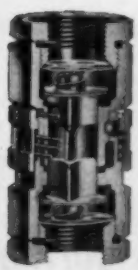
*Snap-Tite

QUICK-CONNECT

QUICK-DISCONNECT COUPLINGS

in larger sizes

immediate delivery
FROM FACTORY STOCKS



SNAP-TITE'S "H" COUPLING: SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHER EFFICIENCY

Snap-Tite's "H" Couplings are now factory-stocked for quick shipment to you, not only in the smaller sizes (below 1" ID) but in all sizes up to and including 3"—in steel, brass, aluminum, and 303 and 316 **Stainless Steel.** And "H" Couplings can be made to your order, up to 10" ID.

Available with valves to give two-way or one-way automatic line shut-off, or without valves for straight-thru flow, "H" Couplings are built to handle high pressures in hydraulic and air systems.

Recessed valve washers . . . fluted valve stems . . . valve stops with minimum flow restrictions . . . large inside diameter—allow maximum flow capacity with lowest pressure drop.

See the Snap-Tite representative in your city or write for Bulletin 240.

*Snap-Tite, INC.

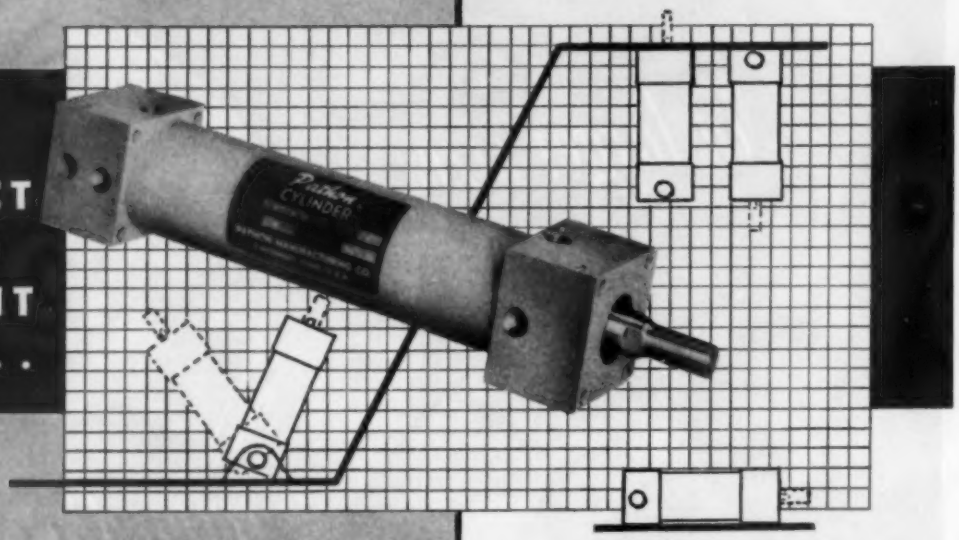
UNION CITY 1, PENNSYLVANIA

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

Complete Flexibility *with a* Pathon

series "U" UNIVERSAL MOUNTING AIR CYLINDER

. . .
they're
COMPACT
RUGGED
EFFICIENT
too . . .



Here is a new series of extremely compact air cylinders which require very small mounting area. You get four mounting types—foot, front flange, rear flange, and clevis provided integrally by drilled holes in the heads. The installation is much more rigid and assembling or stocking of miscellaneous attaching brackets is eliminated.

Stainless steel piston rods and hard drawn brass barrels assure corrosion resistance with low frictional characteristics.

STOCK SIZES: Cylinders available for immediate delivery in these sizes. Part Numbers and Prices Shown.

Stroke	1⅛"	1⅜" Bore	2"	2½"	3"
1"	UA1⅛MA1 26.00		UA2MA1 34.95		UA3MA1 46.00
2"		UA1⅜MA2 28.20	UA2MA2 35.60	UA2½MA2A 51.00	
4"	UA1⅛MA4A 35.20		UA2MA4A 45.20		UA3MA4A 58.40
6"		UA1⅜MA6A 38.20	UA2MA6A 46.50	UA2½MA6A 55.00	
8"	UA1⅛MA8A 36.80		UA2MA8A 47.80		UA3MA8A 62.00
10"		UA1⅜MA10A 40.20		UA2½MA10A 58.20	
12"			UA2MA12A 50.40		UA3MA12A 65.60
15"				UA2½MA15A 62.20	

"A" suffix denotes adjustable cushions both ends

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Self flares all metal tubings
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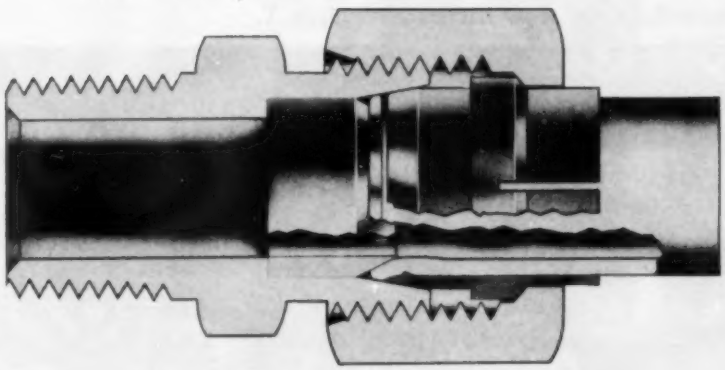

MAKES: Perfect joint because tubing is internally supported by wedge insert upon which self-flare is made as nut is tightened.

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REDUCES: Installation time—because mechanical flaring is eliminated.

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ASSURES: Full, unrestricted flow of fluid through tubing at joint—because pipe fitter is prevented from connecting tubing to fitting unless "cut-off" end of tubing has full, unrestricted passage, free from collapsed walls or inside burrs.

* One piece sleeve with solid rib to bite tube.
Spring fingers absorb vibration and shock.

** With proper tube strength, fitting will hold pressures in excess of 20,000 p.s.i.

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National Conference on Industrial Hydraulics

ON the following pages, the complete program of the 11th annual National Conference on Industrial Hydraulics is published along with abstracts of most of the papers being presented.

The Conference is being held Thursday and Friday, October 27 and 28, at the LaSalle Hotel in Chicago. Anyone interested in the Fluid Power field may attend.

Because some sessions are held concurrently, it is impossible for one person to attend all sessions. The abstracts appearing in this issue will help determine which sessions will be of most interest to you.

Following registration on Thursday morning, there will be a general session at which four papers will discuss the use of computers in the fluid power field. Thursday and Friday there will be sessions on fluids, presses, automotive, pumps, components and accessories, pneumatics, mobile equipment, machine tools and aircraft controls.

The Conference is sponsored by Illinois Institute of Technology with cooperation of the hydraulic industries and engineering societies. It found its beginning in 1945 when Armour Research Foundation and the Graduate School of the Institute recognized the need for close cooperation between the different engineering fields in solving industrial problems. The technical meeting of the 1945 Conference was called "Conference on Hydraulic Machinery." The success of the first Conference led to its establishment as an annual affair. The name "National Conference on Industrial Hydraulics" was selected to better describe the technical content of the meetings.

PROG

OF THE NATIONAL CONFERENCE ON INDUSTRIAL

THURSDAY, OCTOBER 27, 1955

8:30 A.M. Registration: La Salle Hotel, Chicago, Mezzanine Foyer

9:00 A.M. GENERAL SESSION: Illinois Room

Chairman: J. T. Greenlee, Vice President, Imperial Brass Manufacturing Company, Chicago, Ill.

1) Opening remarks by J. T. Greenlee, Conference Director.
2) Welcome to registrants by H. A. Leedy, Director, Armour Research Foundation, Chicago
3) Presentation of APPLIED HYDRAULICS Magazine Awards by Paul L. Reed, Executive Editor.

9.30 A.M. MORNING TECHNICAL SESSION

ANALOG COMPUTERS: Illinois Room

Chairman: Ralph J. King, Staff Engineer, Research Department, Caterpillar Tractor Company, Peoria, Illinois

1) "An Introduction to the Use of Electronic Analog Computers." H. M. Martinez, Chief Applications Engineer, Beckman Instruments, Inc., Richmond, Calif.
2) "A Practical Approach to Analog Computers." John D. Strong, Engineer, Princeton Computation Center, Princeton, N. J.
3) The Analog Computer as a Design Tool In The Study Of a Velocity Control Hydraulic System." Gerhard Reethof, Professor of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

12:30 P.M. LUNCHEON SESSION: Grand Ballroom

Speaker: Raymond D. Meade, Former Member of U.S.I.S. Staff, American Embassy, Bangkok. "Some Aspects of the Recent Economic and Industrial Development of Thailand"

2:00 P.M. AFTERNOON TECHNICAL SESSIONS

HYDRAULIC FLUIDS: Illinois Room

Chairman: F. L. Mackin, General Motors Institute, Flint, Mich.

1) "Hydraulic Fluid and Equipment—Make Them Work Together." C. W. Nichols, Jr., Socony Mobil Laboratories, Brooklyn, N. Y.
2) "Design Considerations for Hydraulic Equipment As Influenced by the Hydraulic Fluid." G. F. Rohrscheib, Hydraulic Engineer, Verson Allsteel Press Company, Chicago, Ill.

PRESSES: Century Room

Chairman: J. J. Slomer, Hydraulic Engineer, Goodman Manufacturing Company, Chicago, Ill.

1) "Trends in Hydraulic Control Techniques for Heavy Presses." L. Mollick, Chief of Stress Analysis, Loewy Construction Co., New York City.
2) "Servo Analysis of a High Horsepower Reversing Pump Application." Merrill A. Hayden, General Sales Manager, Waterbury Tool Division.

AUTOMOTIVE: Lincoln-Douglas Room

Chairman: Merrill R. Bennett, Assistant Manager of Engineering, Industrial Power Division, International Harvester Company, Melrose Park, Ill.

1) "Central Automotive Hydraulic Systems." John Lauck, Vice President and Director of Engineering, Pesco Products Division, Borg-Warner Corp., Bedford, Ohio
2) "Characteristics of the Monroe Air Hydraulic Suspension System." Don Lipp, Project Engineering, Monroe Auto Equipment Company, Monroe, Mich.

6:30 P.M. ALL ENGINEERS' BANQUET: Grand Ballroom

Speaker: Kenneth McFarland, Educational Consultant and Lecturer for General Motors Corporation, Tokepa, Kansas.

FRIDAY, OCTOBER 28, 1955

9:00 A.M. MORNING TECHNICAL SESSIONS

PUMPS: Illinois Room

Chairman: E. Wiedman, Chief Engineer, The Oilgear Company, Milwaukee, Wis.

1) "Methods for Measuring the Performance of Precision Hydraulic Drives." R. E. Davis, Chief Project Engineer, and N. J. Nitka, Engineer, The Oilgear Company, Milwaukee, Wis.
2) "A Search for Controls for Industrial Rotating Hydraulic Drives." Milton G. Malmquist, Supervisor, Instrumentation Development, Minnesota Mining and Manufacturing Company, St. Paul, Minn.

COMPONENT AND ACCESSORIES: Century Room

Chairman: Don Stranberg, Chief Engineer, Anchor Coupling Company, Libertyville, Ill.

1) "Production—Hydraulic Tube Fabrication", Hugh Dorman, Powertube Engineering Company, Olivet, Mich.
2) "Swivel Joints and Their Hydraulic Applications", James O. Heyworth, Sales Manager, Industrial Division, Barco Manufacturing Company.

R A M

HYDRAULICS • 1955 •

PNEUMATICS: Douglas Room
Chairman: R. O. Isenbarger, Chief Engineer, Chicago Rawhide Manufacturing Company, Chicago

1) "Design Factors for Hydro-Pneumatic Shock Absorbers", John T. Ellis, Chief Engineer, Hanna Engineering Works, Chicago, Ill.
2) "Pneumatic-Hydraulic Cylinder Positioners", Claude D. Young, Chief Engineer, Special Design Engineering, Foxboro Company

12:30 P.M. LUNCHEON SESSION: Grand Ballroom
Speaker: Bernard Weissman, Director of Athletics, Illinois Institute of Technology, and Certified Official of the Illinois Athletic Commission. "As a Referee Sees Boxing in Chicagoland"

2:00 P.M. AFTERNOON TECHNICAL SESSIONS
MOBILE EQUIPMENT: Illinois Room
Chairman: J. F. Ziskal, Chief Engineer, Hydraulic Division, International Harvester Company, Chicago, Ill.

1) "The Hydra-Touch System for Farm and Industrial Tractors", G. L. Hershman, Chief Engineer, International Harvester Company, Chicago, Ill.
2) "The Hydraulics on a Continuous Mining and Loading Machine", J. J. Slomer, Hydraulic Engineer, Goodman Manufacturing Company.

MACHINE TOOLS: Century Room
Chairman: Allen Perry, District Manager, Vickers Incorporated, Cincinnati, Ohio

1) "Advantages of Electro-Hydraulics on a Vertical Grinder", R. C. Montanus, Chief Engineer, Springfield Machine Tool Company
2) "Hydraulic Burnishing of Bearing Journals", Z. C. Van Schwartz, Director, Engineering Standards, Baldwin-Lima-Hamilton Corporation

AIRCRAFT CONTROLS: Douglas Room
Chairman: J. T. Marshall, Chief Engineer, Hamilton Division, Bendix Aviation Corporation

1) "Considerations in the Design of High Temperature Aircraft Hydraulic Pumps", J. A. Mileti, Hamilton Division, Bendix Aviation Corporation, Hamilton, Ohio
2) "Effect of Fuel-Carried Dirt on Performance of Power Control System for Jet Engines", J. Barrett, Chief Turbine Engine Control Section, Power Plant Laboratory, Wright Air Development Center, Dayton, Ohio

F. L. Mackin
Chairman
Hydraulic Fluids

E. Wiedman
Chairman
Pumps

J. J. Slomer
Chairman
Presses

Don Stranberg
Chairman
Component Accessories

J. T. Marshall
Chairman
Aircraft Controls

J. F. Ziskal
Chairman
Mobile Equipment

R. O Isenbarger
Chairman
Pneumatics

Allen Perry
Chairman
Machine Tools

Summaries of TECHNICAL PAPERS Presented at 11th NCIH

Here are abstracts of the papers being given at the 11th annual Conference. During coming months, several of the complete papers will appear as articles in APPLIED HYDRAULICS. Complete Conference Proceedings will be published in the spring.

• A PRACTICAL APPROACH TO ANALOG COMPUTERS

By John D. Strong, Engineer, Princeton Computation Center, Princeton, N. J.

The basic components of analog computers, (electronic differential analyzers) and set-up procedures are discussed. Symbols for the components are shown to aid the beginner in reading or preparing analog diagrams. Operating controls for the computer are described and the various operating modes of the computer explained. A simple polynomial evaluation problem is used to illustrate scaling and patching techniques. Integrators are shown, first for independent time drives and later for the solution of differential equations. Analog and digital computers are compared and the choice of which type of computer to use for various types of problems is discussed.

• THE ANALOG COMPUTER AS A DESIGN TOOL IN THE STUDY OF A VELOCITY CONTROL HYDRAULIC SYSTEM

By Gerhard Reethof, Professor of Mechanical Engineering, M.I.T., Cambridge, Mass.

A hydraulic system which is to control the velocity of a large machine tool table is analyzed for its dynamic and steady state response. Velocity control is obtained by measuring the downstream motor flow by means of the pressure drop across a metering orifice and controlling the upstream bypass flow so as to maintain a constant pressure drop across the metering orifice. The dynamic behaviour of the linearized problem is studies on a D. C. analog computer and a stable system is designed.

• AN INTRODUCTION TO THE USE OF ELECTRONIC ANALOG COMPUTERS

By H. M. Martinez, Chief Applications Engineer, Berkeley Div., Beckman Instruments, Richmond, Calif.

A categorization is made of the main uses of electronic analog computers. This categorization is based upon the principle of Simulation and its application to engineering and scientific problems. Also considered is the purely mathematical nature of these computers, and the type of accuracies to expect of solutions to problems.

• HYDRAULIC FLUID AND EQUIPMENT—MAKE THEM WORK TOGETHER, Part I

By George F. Rohrscheib, Hydraulic Engineer, Verson Allsteel Company, Chicago, Ill.

Hydraulic fluid and the equipment it's used in, should be considered as complementary parts of an operating system. Both parts should be designed to give maximum operating efficiency when working together. Part I of this paper deals with the significant performance properties of the fluid. It points out how these characteristics are influenced by the design of the system and how the fluid properties

C. W. Nichols

J. D. Strong

H. M. Martinez

G. Reethof

may be controlled to best suit the unit. Factors affecting chemical stability, wear prevention, fire resistance and other critical requirements are discussed in some detail. Both petroleum and synthetic fluids are considered in the light of their differing influence and susceptibilities.

● HYDRAULIC FLUID AND EQUIPMENT—MAKE THEM WORK TOGETHER, Part II

By C. W. Nichols, Jr., Socony Mobil Laboratories, Brooklyn, N. Y.

Part II of this paper deals with the decisions that the designer must make to handle the problems which arise from the use of a hydraulic fluid. All of these fluids have certain characteristics which must be recognized and designed for. The characteristics are each different for the various fluids. The designer must be able to understand them, and, in understanding them, be able to meet their conditions. Where here-to-for the designer had one set of rules to follow, with very few modifications, he is now not only faced with the same set of rules but two and possibly more sets of by-laws which modify those rules. Fire-resistant fluids are not a replacement for, but are a complementary fluid to the petroleum oils. Each has its position in the field of hydraulics and each must be designed for according to its peculiar characteristics.

● TRENDS IN HYDRAULIC CONTROL TECHNIQUES FOR HEAVY PRESSES

By L. Mollick, Loewy Construction Co.

With the design of presses of ever increasing capacity, the problem of precise and reliable control assumes an increased importance.

Not only must operations, which have heretofore been manual, be "automated"; the press functions under the operators' control must be remotely controlled and power amplified. This involves the introduction of feed back control techniques. Some hydraulic circuits illustrating these concepts will be discussed. Among these will be some designs utilizing feed back techniques for synchronizing cylinder speeds and for controlling press speeds under varying load conditions.

In applying forces in the thousands of tons, the safety problems are given increased emphasis. For example, the possibility of excessive eccentric loading must be adequately resolved. Circuits for automatic compensation of eccentric loading will be presented. Utilization of electronics in connection with hydraulic control will also be discussed.

Many essential fail safe features will be discussed and particular attention will be given to the Air Force Heavy Presses and some control techniques for presses now in the design stage.

● SERVO ANALYSIS OF A HIGH HORSEPOWER REVERSING PUMP APPLICATION

By Merrill A. Hayden, Waterbury Tool Div.

This paper, delivered in two parts, describes the approach and the solution of the servo analysis problem on the world's largest tube reducing machine built by E. W. Bliss for Tube Reducing Corporation and incorporating Waterbury 2300 gpm 3,000 psi reversing pumps.

The first part describes the machine, the operation sequence, the operating requirements and the pump in sufficient detail to serve as a background for the servo analysis.

The second part of the paper describes the servo control system of the machine and the approach and methods used in analyzing them.

● CHARACTERISTICS OF THE MONROE AIR HYDRAULIC SUSPENSION SYSTEM

By Donald W. Lipp, Project Engineering, Monroe Auto Equipment Co., Monroe, Mich.

Current streamlined automobile designs have gradually reduced jounce space to the point where excessive bottoming of the suspension is often encountered in spite of springs with rates which are often higher than desirable.

The Monroe air hydraulic suspension system utilized the compressibility of air as a spring medium together with an integral hydraulic shock absorber

for damping. Coupled with the air spring and hydraulic shock absorber is a comparatively simple leveling device. This combination results in a low oscillation frequency for the suspension. The leveling valves maintain the vehicle at a uniform riding height regardless of load conditions. Constant spring deflection produces a fixed oscillation frequency and uniform riding characteristics with any load or road conditions.

Two types of air spring units have been designed and tested. One design consists of a telescoping metallic tube unit with special anti-friction bearings

D. W. Lipp

J. A. Lauck

resiliently mounted to provide self-alignment. Synthetic rubber seals are used to maintain the air pressure. The second type of air spring is the rubber bellows spring. This spring consists of a rubberized cord bellows with the diameter and number of convolutions dependent upon the loads to be carried and the desired frequency.

In both air spring designs a hydraulic shock absorber is an integral part of the unit, centrally located within the air spring and is used as a structural member which actually ties the axle to the body or frame.

One of the many advantages to be derived from the use of the Monroe air hydraulic suspension system is the utilization of the available air supply for power brakes, window lifts, seat adjusting mechanism, air horns and windshield wipers thus relieving the already overloaded electrical system of the modern automobile.

● CENTRAL AUTOMOTIVE HYDRAULIC SYSTEMS

By John A. Lauck, Vice President and Director of Engineering, Pesco Products Div., Borg-Warner Corp., Bedford, Ohio

This paper discusses the various methods by which hydraulics can be applied to the automotive and truck industry and the advantages and disadvantages of these various systems.

The system, which has been selected as being the most desirable from an operational and horsepower usage, is fully detailed.

Each element of the system is discussed, giving its operational and safety characteristics.

This system can be applied to any vehicle or item of equipment which requires more than one functioning unit to be operated hydraulically.

● A SEARCH FOR CONTROLS FOR INDUSTRIAL ROTATION HYDRAULIC DRIVES

By Milton G. Malmquist, Supervisor, Instrumentation Development, Minnesota Mining & Mfg. Co., St. Paul, Minn.

The paper is concerned with hydraulic drives for machines placed in tandem performing operations on continuous webs. It more specifically deals with a search for suitable controlling means for these drives. The systems described consist fundamentally of a variable displacement pump supplying a fixed displacement motor. A brief discussion is given of the basic tension and speed problems encountered in handling webs through several machines in tandem. All-hydraulic controls are discussed, including: two types of synchronized drives using small pumps as hydraulic tachometers; a mechanical dancer-roll control; and an unloading valve tension control. Examples are given of the application of pneumatic instrumentation to hydraulic drives, including: remote setting of machine speed; remote setting of motor torque; a constant tension winder; and a tension control superimposed on a speed-synchronized drive. The paper is illustrated with schematic circuit diagrams of the systems described. The author concludes with the opinion that there is a need for more and better control components to utilize fully the potentialities of rotating hydraulic drives for industrial use.

● METHODS FOR MEASURING THE PERFORMANCE OF PRECISION HYDRAULIC DRIVES

By Richard E. Davis, Chief Project Engineer, The Oilgear Co., Milwaukee, Wis.

Closed loop hydraulic speed control systems have very high accuracy. Measurement of system errors demands precise measuring techniques. Similar techniques can be used to obtain frequency response and transient response of such systems. The latter data gives a great deal of insight into the nature of the system.

We first consider the error measuring problem of a typical system and outline two measuring methods: use of synchros on input and output shafts driving a differential synchro whose motion is timed to give differential speed error; and use of an electronic timer measuring pulses produced by

Continued on page 114

Announcing

THE 1955 AWARD WINNERS

Each year APPLIED HYDRAULICS sponsors a contest which offers all readers the opportunity to submit an article. On the following pages award winners are announced, and the three top papers are published. During coming months all papers winning cash awards and given honorable mention will be published. These papers represent outstanding examples of design, application and operating techniques. Each entry was evaluated on the basis of practicality, economic value, originality and presentation. Judges for the 1955 Contest were William E. Adamek, Senior Production Engineer, Fisher Body Division, General Motors Corporation, David Hutchinson, Sundstrand Machine Tool Company, and Joseph F. Ziskal, Chief Engineer, Hydraulic Division, International Harvester.

First
AWARD PRIZE
$500

JOSEPH H. COHEN

Joseph H. Cohen, Design Engineer, The Cross Co., Detroit, Michigan, "Design of a Hydraulic Power Unit for a Multi-Station Transfer Machine."

Practical approach to layout and selection of reservoir, pumps, valves and piping to meet space, cost, safety and maintenance requirements. Drawings show possible variations in the arrangement of components.

Second
AWARD PRIZE
$300

EDWARD L. BRONSTIEN, Jr.

Edward L. Bronstien, Jr. and Richard A. Fisher, Engineering Department, The United States Bedding Co., St. Paul, Minnesota. "A New Development— Fluid Power in the Home."

A truly new application for oil power—opening and closing a convertible bed davenport. The full story of this development is detailed. This miniature power package literally opens the door to everyday applications of fluid power in the home.

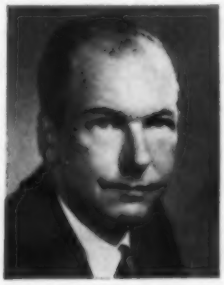
RICHARD A. FISHER

Third
AWARD PRIZE
$200

JOHN E. MINTY

John E. Minty, Director of Engineering and **Raymond L. Ober,** Project Engineer, Manning, Maxwell & Moore, Inc., Muskegon, Michigan. "Hydraulic Overhead Traveling Crane."

This is the story of the first practical design of an overhead crane which was built this summer using fluid power for all three crane motions—the bridge, the hoist and the trolley.



RAYMOND L. OBER

Fourth-Seventh Prizes

$50 EACH

Robert E. Raymond, Project Engineer, Simplex Engineering Co., Zanesville, Ohio. "Locked Parallel Cylinder Operation."

How can two cylinders operating against unequal loads be made to move in synchronism? Mr. Raymond describes a circuit in which two parallel cylinders are made to move exactly together over a stroke of 13 feet. The circuit works without the use of metering valves or an elaborate servo system.

William M. Richner, North American Aviation, Inc., Los Angeles, California. "Flowmeter Calibration Program."

Flow measuring devices have become increasingly important in testing aircraft hydraulic systems. To reduce production costs caused by inaccurate flow measurements, a program for eliminating these errors has been devised. This paper describes the methods used to accurately calibrate variable-area flowmeters.

Rex C. Burnham, Hydraulic Division, Manager, J. N. Fauver Co., Inc., Detroit, Michigan. "Hydraulic Motors, their Applications and Shortcomings".

A complete, up-to-date analysis of fluid motors which tells where motors serve best, which circuits work best and some "don'ts" to keep the user out of trouble. Reasons for applying fluid motors are given; gear, vane and piston type motors are compared. Slippage, deceleration, braking, torque, speed and efficiency are some of the aspects discussed.

J. R. Fawcett, Timperley, Cheshire, England. "A Dual Traverser for Loading Planing Machines".

Reducing idle time on a planer can be done by having false tables which permit loading while the machine is working. Mr. Fawcett's drawings show a circuit used to traverse 12 foot tables a distance of 8 feet. The problems of synchronizing movements and eliminating trailing hoses were solved.

Honorable Mention

C. R. Chew, Cecil C. Peck Co., Cleveland, Ohio. "Pneumatics in Machine Tools for Automatic Arc Welding".

Thomas Baxter, Leland Electric Canada, Ltd., Guelph, Ontario, Canada. "How Pneumatics Lowered Costs in the Development of a Special Purpose Machine".

Alexander D. Roubloff, Wiesner Rapp Co. Farnham Mfg. Div., Buffalo, N. Y. "Hydraulics Solves Redesign Problem of Countersinking Machine".

J. W. Houser, Willow Grove, Pennsylvania. "Variable Delivery Pump and Motor".

Seymour S. Garrett, Greer Hydraulics, Inc., Jamaica, N. Y. "Accumulator Applications".

James Tankard, Zagar Tool, Inc., Cleveland, Ohio. "Surge Control Under Extreme Conditions".

Hans W. Hamm, S. Morgan Smith Co., York, Pennsylvania, "Heat Dissipation".

W. M. Sanderson, Dow Corning Corporation, Midland, Michigan. "Two and Three Station Valve Control".

C. R. Taylor, Berry Division, Oliver Iron & Steel Corporation, Pittsburgh, Pennsylvania, "Cooling by Hydraulic Drive".

George Kartman, Rexdale, Ontario, Canada. "A First Step Towards Automation".

Daniel A. Keefe, Dow Chemical Company, Western Division, Pittsburg, California. "A Pneumatic System to Open Bottom Dumping Railroad Cars".

W. J. O'Connell, Dayton, Ohio. "All Pneumatic Control Circuitry".

John D. Helms, Sr., Intercontinental Mfg. Company, Inc., Garland, Texas. "The Design & Development of a Hydraulic Powered Offsetting Machine".

Clifford J. Lane, Lane Engineering Company, Buffalo, New York. "A Simple Time Delay Pneumatic System".

Eric Holdsworth, Turner Tanning Machine Company, Ltd., Leeds, England. "Impact Air Cylinders".

J. B. Patterson, Sonoco Products Company, Hartsville, South Carolina. "Automatic Transfer Machine".

William MacLeod, and W. C. Nuckles, United Aircraft Products, Dayton, Ohio. "Electrically Controlled, Hydraulic-Operated, Detent Forming Machine".

Paul H. Winter, Pass & Seymour, Syracuse, N. Y. "Electro-pneumatic Machine Processes Porcelain".

FIRST

PRIZE • JOSEPH H. COHEN

Design of a Hydraulic Power Unit for a Multi-Station Transfer Machine

SEVERE limitations very often point up problems that have been with us for a long time, but haven't bothered us quite enough to do something about. Such were the conditions prevailing when it became necessary to design the 100 gallon hydraulic reservoir and multi-pump power unit.

The customer for the Transfer-matic gave the following specifications relative to the hydraulic equipment:

1. Complete conformance to J.I.C. standards.
2. A separate pump for every feed unit.

These specifications were not of any special concern until it became evident that individual hydraulic power units would not fit into the floor space allotted. After inquiry among vendors of hydraulic equipment it was decided to build a power unit of our own.

After a survey of the prior use of hydraulic power units and projecting use into the future, the following specifications were set up:

1. Conformance to J.I.C. standards.
2. The power unit must occupy a minimum of floor space relative to the hydraulic power supplied.
3. The basic design must embody extreme flexibility relative to its possible applications.
4. All portions of the power unit must be accessible for service and maintenance requiring minimum service time to replace components.
5. The power unit must be a useful part of the machine, that is, provide means for connecting and supporting hydraulic components and piping.
6. The cost of this power unit must be low enough to justify the use of very scarce engineering and shop time.

EACH TOOL FEED UNIT requires a separate pump. A power package must also be designed to power the transfer and clamping mechanism. On this machine it was determined that each power unit can have no more than four pumps.

Individual pumps of 4, 7, 10 and 14 gallon per minute capacity are required to serve the various sizes of hydraulic feed units. Pump capacities ranging from 5 to 38 gpm were required to power the accessory drives such as pallet transfer, pallet clamping, and hydraulic power wrenches.

The pump types used include fixed displacement vane pumps, high and low volume combination pumps and automatic variable displacement pressure compensated pumps. Since these pumps are not all made by the same manufacturer interchangeability of pumps on the basic design was one of the problems.

After working up a layout of the machine it was noted that for convenience of piping and accessibility it was undesirable to serve more than four hydraulic feed units from any one point around the machine. It was therefore determined that each power unit would have no more than four pumps. It was also noted that about 50 gpm was the maximum hydraulic volume required at any power unit. Starting with the rule of thumb of having reservoir capacity equal to twice the number of gallons being pumped per minute, 100 gallon actual reservoir capacity was chosen as being adequate for the maximum pumped capacity and very generous for all other conditions.

DIFFICULT SPACE PROBLEM

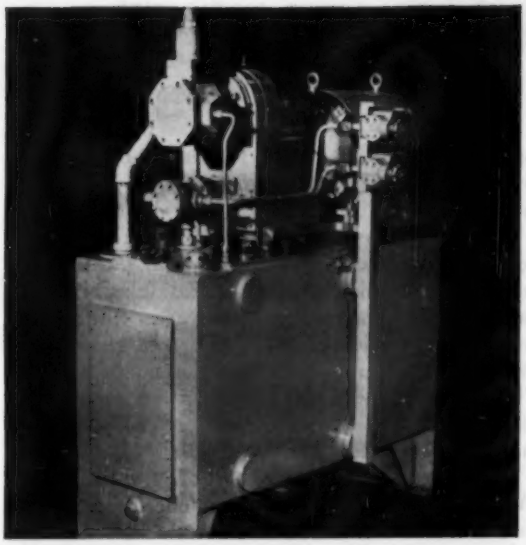
Now, in considering four pumps on one power unit our space problems became more acute, requiring provisions for four pressure control devices, and possible directional control valves. It was decided that the most efficient way to utilize the space available was to use all gasket mounting valves. These valves would then have to be mounted on a suitably accessible manifold or manifolds provided with suitable pressure, tank, and drain facilities. The use of bleed off filters was also considered.

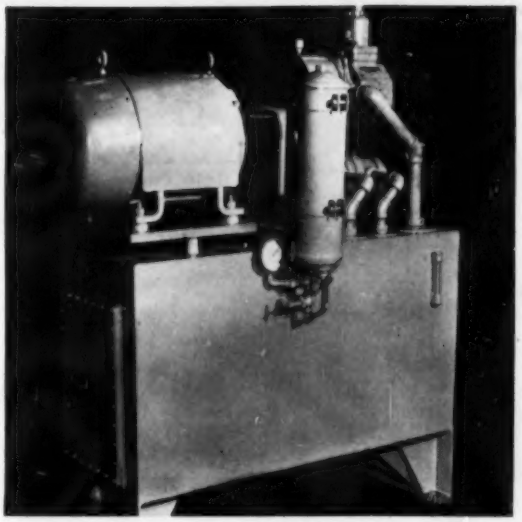
One of the biggest problems in the design and erection of large multi-unit hydraulic machines is the disposal of electrical and hydraulic piping. These pipes occupy a great deal of space and the space to carry piping neatly is very limited. Electrical conduit can be minimized to a great extent by building conduit passages into machine components. Not so with high pressure hydraulic fluids. The length and number of passages in a machine component is limited by manufacturing processes and the physical size of components. Whereas all the electric wires can be put together in one compartment or passage, each hydraulic line must be separated.

Considering that each feed unit must be isolated, we have a minimum of 12 pipes connected to the power unit that must go to feed units, as well as the piping that must connect the pressure control and directional valves to the pumps and reservoir. It becomes evident that this imposing array of plumbing deserves considerable effort in the way of manifolding to reduce the number of pipes and joints to assemble and maintain.

This power unit must have optimum maintenance features since it serves four feed units instead of only one. Therefore it was decided to have two filler-vents, two oil-level gages, and two clean-out covers. These features arranged so that one set is accessible no matter how the power unit could be placed around the machine.

Oil temperature control had to be considered. This is something that depends on the final design of the reservoir. Some methods considered include heat exchanger, extending the cooling surface of the reservoir, specially finned clean-out covers, clean-out covers with water passages built in and forced air cooling.





VIEWS of one of the completed designs. A single motor drives two pumps, one fixed and one variable displacement, through a gear box.

APPROACH TO THE PUMP LAYOUT

Having set forth the principles around which this power unit was to be designed, brought us to the actual problem of the design. One obvious solution was to mount two tandem pumps side by side as shown in Figure 1. This gave us four independent pumps on one power unit. Although this was less space consuming than two separate power units it used more floor space than we could afford and was clumsy maintenancewise.

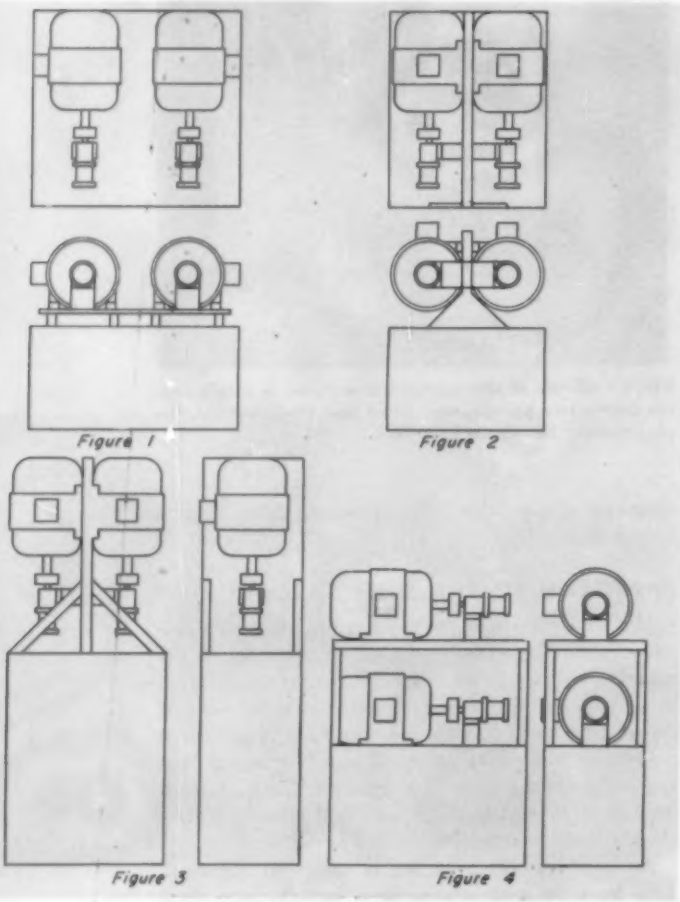
An improvement over this is shown in Figure 2. This back to back arrangement saved more floor space, but left us with a poor piping situation.

Figure 3 shows the ultimate in floor space saving

design. However, to get a 100 gallon capacity the reservoir became so tall as to hinder proper maintenance.

Figure 4 shows a compromise between floor space economy and maintenance accessibility. After due consideration this design was set aside as being too amateurish in concept and appearance. However, in spite of its undesirability this design showed the way to the power unit configuration finally adopted. This design showed that there was both economy of floor space and accessibility when one pump was mounted over the other.

This over and under idea sort of grew like Topsy. With each improvement another one came. Finally when it was decided to drive both sets of pumps with one motor, flange mounting the pumps to one gear box saved pump mounting construction. Obviously since we already had a gear box, making a 1.5:1 reduction between the motor gear and the pump gears cost us nothing. It reduced our motor cost to about half of that of previous designs, by using one 1800 rpm motor instead of two smaller ones at 1200 rpm.



FIGS. 1-4. POSSIBLE PUMP arrangements to provide four pumps in one package.

We eliminated the need and the space required for flexible coupling between the pumps and their driving gears by making a close coupled arrangement, inserting the pump shaft inside of its driving gear and providing a good pilot for the pump. The motor and gear box are mounted on common plate which is raised over the top of the reservoir by short bosses which serve a two-fold purpose. It reduces the heat transmission to the motor and gear box and it provides a space to run piping, that does not occupy otherwise useful space. The motor plate is so supported that flexure merely produces angularity in the coupling between motor and gear box without causing any additional loads on the motor or pump bearings. An area is reserved for connecting piping from the feed units, with enough tapped holes provided to connect all pipes individually. Two places are provided to accommodate pressure control and directional valves. This manifold or manifolds provides a surface to gasket mount these components at a level that is convenient for servicing and provides a path to return oil to the reservoir through its support. Two filler vents with screens are provided on opposite sides at the top of the reservoir. Two oil level gages are provided on opposite sides, and two cleanout covers and drains are provided on the ends. A removable baffle separates the suction side from the return side. The whole reservoir is raised a substantial distance off the floor. This makes all the components at a level that is easy for servicing by a man standing erect.

A brief outline will show the flexibility of this type of design. Since the gear box is really a separate assembly it is possible to vary the pump mounting face by merely making a new cover from one of the simple patterns that we have. The pump combinations designed for are as follows:

1. Two-single stage or double vane type pumps, Figure 5-A.
2. Two-two pressure combination pumps, Figure 5-B.
3. Two-variable volume pressure compensated pumps, or any combination of two of the above mentioned pumps, Figure 5-C.

Each pump position has capacity of from 1.5 to 30 gpm with these combinations, see Figure 5D.

ARRANGEMENT OF VALVING

With the single stage vane type pumps pressure control valves are always necessary, therefore, a series of manifolds for mounting 2, 3, or 4 pressure control valves is provided. This manifold not only acts to support the valves, but the support is also the return for the excess oil. For mounting directional valves similar manifolds are provided to handle 1, 2, 3, or 4 directional valves. The variety of directional valves has been limited to the ¾"

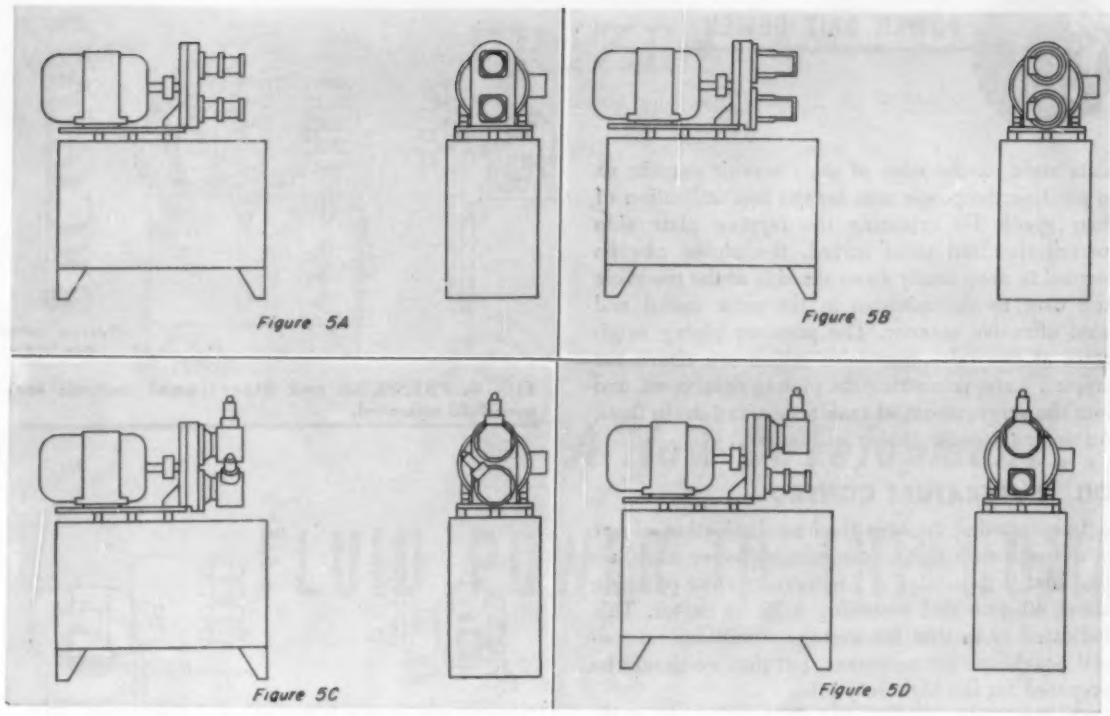


FIG. 5. POWER UNIT arrangement offers flexibility in selecting pump combinations.

pilot operated types which are available interchangeably from a number of manufacturers. Here again the support acts as a tank return line. It is readily apparent that this manifold system lends itself to a tremendous variety of valve combinations, all accessible and without a maze of piping to maintain. Some of these combinations are shown in Figure 6.

True accessibility as we use the term today, is the ability to remove and replace any part on an equipment without disturbing any other part. Let us test our power unit for accessibility. Every suction strainer is piped to its pump with an elbow-union, so that any strainer can be removed from the reservoir by releasing the union and pulling the strainer up through the hole provided in the top of the reservoir. Every run of piping can be removed without disturbing any other run. To remove a pump, however, we must disconnect it from its piping. We justify our negligence in this respect with the fact that gasket mounting pumps are not available in all sizes and with all characteristics of pressure and displacement. However, any pump can be replaced without disturbing any other pump. All the piping is brought to the reservoir on top, so that the oil need not be drained to service any pipe or component. The large end covers permit removing the baffle and cleaning the inside of the reservoir without disturbing any piping or component.

The manufacturers of hydraulic power units generally overlook the fact that these power units must be connected to something else by means of pipes. They seem to feel that their duty is discharged when they furnish one pressure connection, one tank return connection and one drain connection somewhere on the reservoir. Little regard is given to convenience of piping. The piping problem is tremendous on a machine with multiple feed units even though each one may have a separate hydraulic system. We, therefore, gave this problem very serious and extensive consideration in the design of our power unit.

PIPING LAYOUT

We considered that the number of pipes connected to our reservoir varies with the application and that more than one set of connections per pump is very often necessary. As many as eight feed units have been operated with one variable volume pressure compensated pump. In order to minimize our piping problem a tapping plate is furnished along one edge of the power unit. This accommodates all of our tank return and drain lines. The tank return points have bushings which are tapped from both sides. A nipple extends downward from the bushing to deliver the return oil below the surface of the oil in the reservoir. The drain lines from valves are merely tapped into the plate, permitting the drain oil to dribble down to the surface of the oil in the reservoir. Hereby we have furnished ourselves a means for readily attaching individual pipes in a neat and compact manner, and having the tapping

plate right on the edge of the reservoir permits us to position the power unit for the best utilization of floor space. By orienting the tapping plate side toward the feed units served, the piping can be formed to drop neatly down the side of the reservoir and over to the machine in the most useful and least offensive manner. The pressure piping originates at the valve manifolds which are above the tapping plate, permitting the pipe to drop down and join the arrangement of tank return and drain lines. An arrangement is shown in Figure 7.

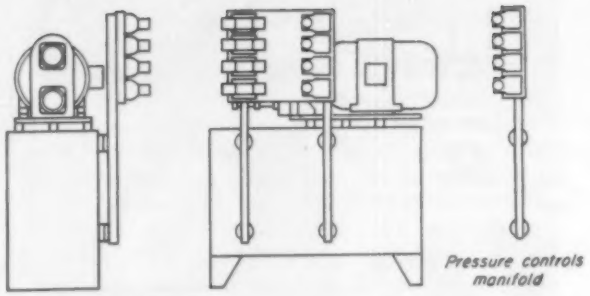


FIG. 6. PRESSURE and directional controls are manifold mounted.

OIL TEMPERATURE CONTROL

In comparing the area for heat dissipation of our power unit with that of commercial power units, we find that it is similar to commercial units pumping about 40 gpm and mounting a 20 hp motor. This indicated to us that for average conditions no special provisions are necessary, but that we should be prepared for the high-duty jobs.

Our power unit is arranged so that the baffle causes a large oil flow past our end covers. By making an extended surface cover of a highly conductive material, it is possible to double the cooling capacity reservoir. By welding fins to the bottom of the reservoir it is also possible to double the cooling capacity of the reservoir, not including the end covers. Another method for controlling the reservoir oil temperature is to have water-cooled end covers.

Oil-to-water heat exchangers require more attention and regular maintenance than oil-to-air heat exchangers and are, therefore, not as desirable.

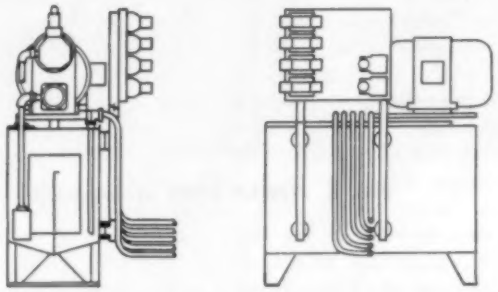


FIG. 7. A TAPPING plate minimizes the piping problem between power unit and machine.

AND ABOUT THE COST

Since we build power units in rather small quantities compared with the regular manufacturers of such devices, we must justify our efforts with some worthwhile economies. One outstanding economy is in floor space required. Considering the number of pumps, the pumping capacity, and the space required for maintenance our power unit only consumes one-third of the floor space required by equivalent commercial units. Having this reduced floor space requirement very often permits us to build a machine of smaller overall dimension. Then, when desired, our power unit can be furnished with a single valve manifold, a single filter, a single motor and control, a single motor mounting, coupling and guard while the equivalent in commercial units would reguire a multiplicity of these items. The motor economy is greater than mere reduction in num-

Continued on page 88

About the Author

Joseph H. Cohen is in charge of standards at The Cross Company in Detroit. His experience at Cross includes one year in charge of the controls department and four years in research and development of machine components. He is a registered Professional Engineer (Michigan). Before going to Cross he worked for 11 years with National Broach and Machine Company. He was in charge of their controls department for four years. Mr. Cohen holds an M.E. degree from Wayne University, 1937.

SECOND

PRIZE

● EDWARD L. BRONSTIEN, Jr.
and RICHARD A. FISHER

A New Development...

FLUID POWER IN THE HOME

THE convertible bed davenport has gone automatic! No more struggling with over 200 pounds of steel levers and mattress trying to fold and cram them into a sofa base. Now just the touch of a button, and let hydraulics do the work—automation in the living room! The apartment or guest den now has a beautiful sofa by day and a comfortable luxurious bed by night at just the touch of the lady's finger. Similar in action to the automobile convertible top, the Hydramatic Davenbed (Registered Trademark) also uses oil hydraulics as an economical and reliable method of accomplishing a fairly complicated motion. Let's examine the problem of automating the manual davenbed more closely and see why oil hydraulics was chosen as a source of power even though it meant over two years of research and development to evolve a specially designed miniature pump, special fittings, special tubing and cylinders.

The hidden bed dates back to the early 1800's. Early patents show beds hidden in everything from bath tubs to tables. The wall bed became popular many years ago, and within the last twenty years the sofa bed has become the most prominent. As the styling of sofas changed and as mattresses became firmer, the problem of stuffing a king size

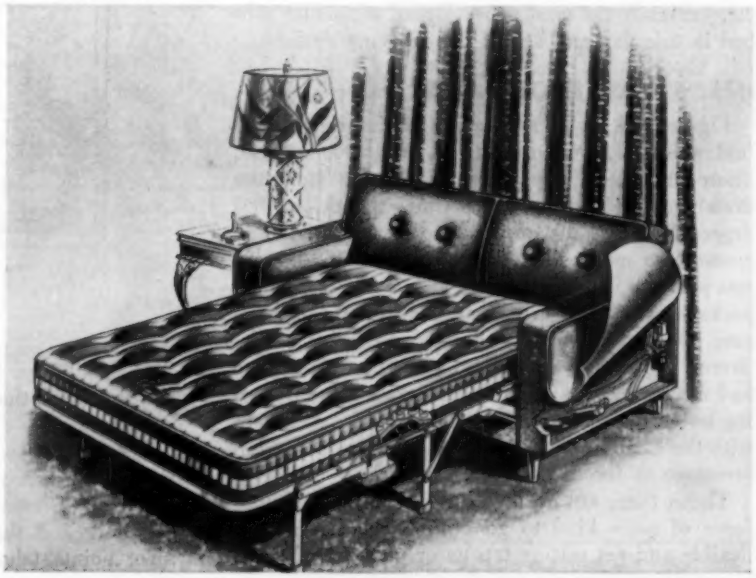


FIG. 1. OPERATING mechanism can be seen in opened arm. Motor driven pump is on back wall.

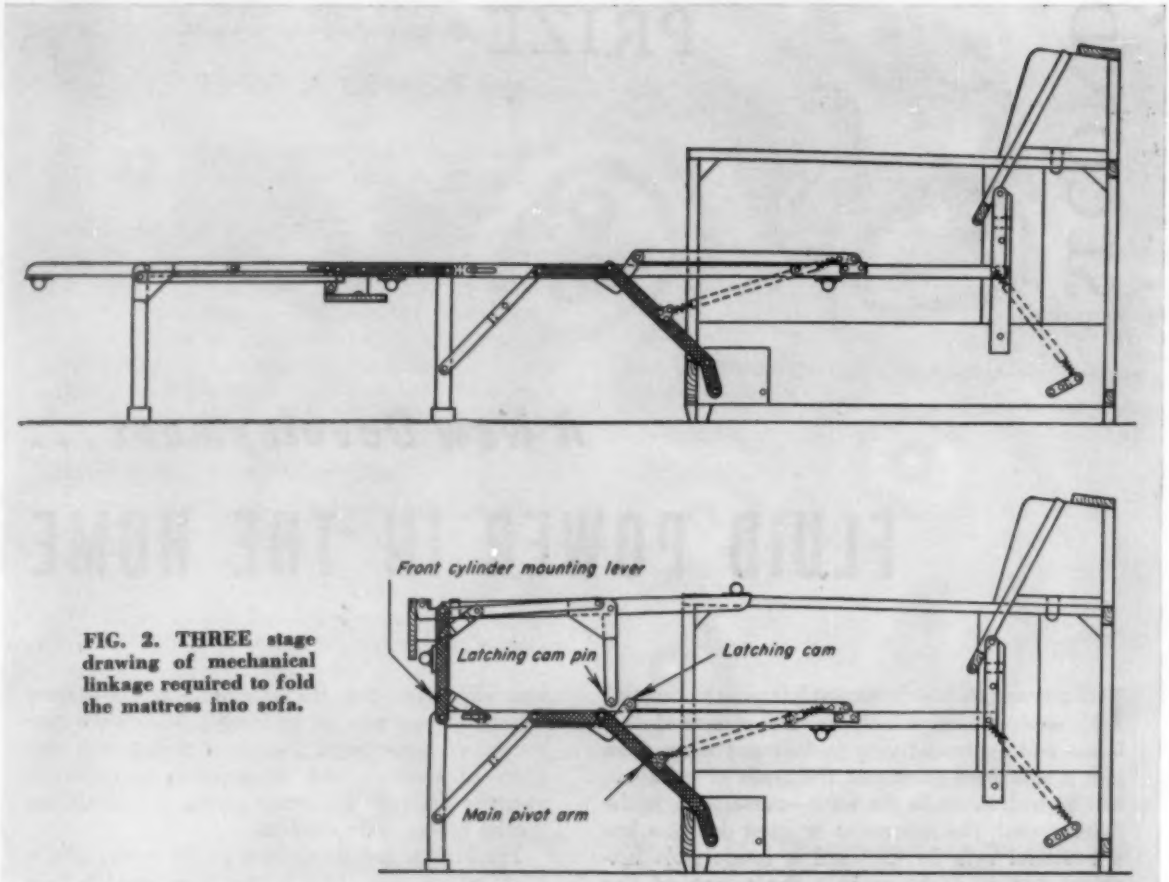


FIG. 2. THREE stage drawing of mechanical linkage required to fold the mattress into sofa.

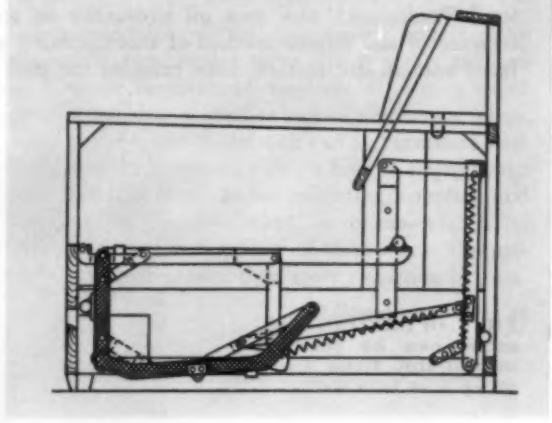
mattress into a dainty looking sofa became more and more complicated. Today, more than one million hand operated sofa bed combinations are sold yearly. In spite of heavy counter balancing springs, the mechanisms are not easy for a woman to operate. Certainly the need exists for an automatic sofa bed in this day and age of labor saving devices.

HERE'S HOW IT OPERATES

Figure 2 shows the mechanical motion required to fold a bed frame and mattress into a sofa base. There are two distinct motions as seen from the drawing. The foot end of the frame makes one 180 degree fold, and then this whole section is pivoted around the main pivot arm until it is in the sofa seat position (Shaded arms in Figure 2). The power package can only be in the arm of the sofa to make sure it does not show—and yet power must be delivered to the foot end of the bed. Due to the very bad mechanical disadvantage in locating the actuating levers in positions where they wouldn't interfere with the sitting or sleeping position, extremely high pressures or forces are encountered.

These, then, are the two basic problems—getting force of some kind to go around corners and be flexible and yet getting torque or pressure of up to nearly 2000 psi. Sounds like a job for hydraulics, you say. Well, that's true—but our troubles are just beginning.

The first step was to locate the actuating cylinders in such a position that the double fold motion could be accomplished. Figure 3 shows the location of the cylinders and their folding action at the critical pivot points (shaded levers). Due to the leverage



and upholstery problems, the dimensions of the cylinder are extremely limited. Figure 4 shows the cylinder which was designed to give the greatest stroke in the minimum space. Even inside plugs were used as there was not enough space to use a threaded cap.

The sequencing of these cylinders is accomplished by the mechanical lock of the folding steel leverage. When the bed is fully closed, the front cylinders are locked by the latching cam jaw as shown in Figure 2. This means that under hydraulic force, the pressure will mount until the main pivot arm cylinders can lift the whole section out of the wood frame. When they reach the end of their stroke, the pressure mounts until the front cylinders take over the unfolding of the foot section. In closing the bed, the cantilever length of the construction is too great for the arm cylinders so the pressure builds up until the front cylinder rods extend and when the end of their stroke is reached, the pressure then forces the arm cylinders to close. The dimensions and stroke length of these cylinders must be exact. Too long or too short a stroke will cause the steel frame to buckle and/or rivets to snap as the sequencing becomes inefficient and the force or pressure is not properly transferred.

With this system of cylinders, we managed to get a bed built with an old aircraft surplus pump, a hand crank and four crude large cylinders which protruded from spots in the bed where the occupant's rear end was prone to hit the cylinders when rolling over at night! The hand crank was harder to turn than operating the bed manually, and certainly we needed improvement.

Next step was the addition of a ¼ hp motor and gear reducer to operate the pump. The total cost of the power unit alone now was $515.00! We were dreaming of a $15.00 or $25.00 power package which would make the item marketable to the general public. All we had was a clumsy, oversized noisy sofa which was far too expensive to produce. Well, at least we had a workable item and model! We were now faced with the problem of redesigning the entire unit to make an electric hydraulic sofa bed feasible as a commercial item. We thoroughly investigated all the miniature pumps and cylinders that were available in commercial market. We found nothing as a stock item which we could use in large quantities in order to put this bed on the market. Instead we found that we had to redesign and build our own pump, our own cylinders and somehow our own tubing and fittings. Figure 5 is a graph showing pressure vs. time in the opening cycle of the bed. It is apparent that our high pressures are obtained for only a fraction of a second at spots in the cycle where the leverage is especially poor. Due to the small lines and small cylinders, the oil flow is almost negligible, and at peak pressures there is practically no flow.

THE PUMP

The pump is, of course, the heart of the power package. After an exhaustive search of commercial minature high pressure pumps, we decided a gear pump would be the most economical and the easiest to design. The external gear pump as shown schematically in Figure 3 contains a very interesting circuit which is desirable in an item of this type. Note that the oil flow to the pump always returns to the reservoir. The oil pressure port always draws

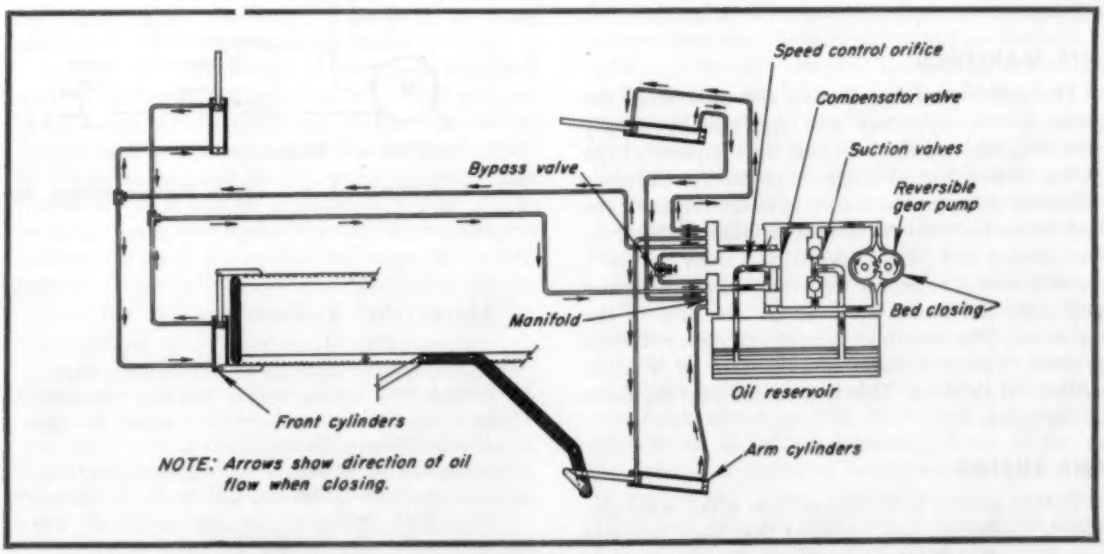


FIG. 3. SCHEMATIC of hydraulic circuit; shaded levers refer to the same arms in Fig. 2.

fresh oil from the tank. This allows any dirt or air to settle out in the reservoir and practically eliminates the problem of bleeding 67 feet of tubing and four cylinders. This pump, as designed, was highly efficient if manufactured to close tolerances. With a small 1/6 hp. series motor connected as a direct drive to the driven gear, pressures of up to 1800 psi for a short period of time were developed. An internal gear pump is also being used which is simpler in design and somewhat cheaper to manufacture. We are presently using motor parts in the cast pump housing which reduces the physical size of the unit to approximately a cylinder of about 3" in diameter and about 7" high. This power unit is extremely rugged and will hold well at peak pressures for some time. It is completely sealed and may be tipped in any position—an important consideration for shipping. Although both of these pumps followed ordinary commercial pump designs, we had to evolve a product which was extremely economical and which produced a pressure of 1500 psi at .2 gallons per minute.

The bed is timed to open or close in approximately 18 seconds. During portions of the cycle (low points in pressure curve, Fig. 6) the weight of the mattress tends to motorize the pump. Without some type of damping control, the Davenbed will slam at each extreme end of the cycle. The speed control orifice as shown in Figure 3 acts as a restriction in the line and creates enough back pressure to keep the end of the leverage from falling due to its own weight. This one disadvantage however is that the return oil flow rate is reduced and must be compensated for by increasing the input pressure to the cylinders. This same action can also be partially accomplished by the use of external mechanical balance springs on the leverage. (See Fig. 2).

THE MANIFOLD

The problem of distributing the fluid from the pump to the cylinders was resolved by simply mounting the manifold directly on the ports of the pump. Although good hydraulic practice would place either the pump or the manifold in the center of the bed frame for even pressure distribution, the problem of cost and "the nature of the beast" made it more practical to mount the manifold on the pump and place this entire assembly in one arm of the davenbed. The manifold consists of standard compression fittings brazed into the face of a small drilled out cylinder. This is threaded into the ports of the pump.

THE TUBING

Tubing seemed to be the one item which was completely neglected, not realizing that high pressure

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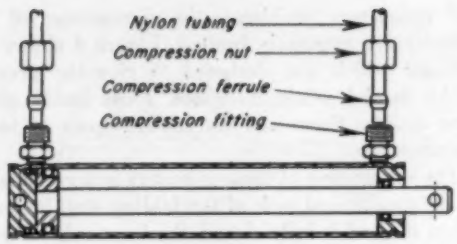


FIG. 4. CROSS-SECTION of hydraulic cylinder having a one inch bore and five inch stroke.

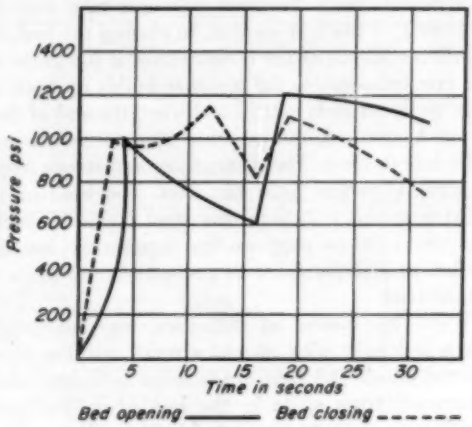


FIG. 5. GRAPH of pressure or leverage force against time.

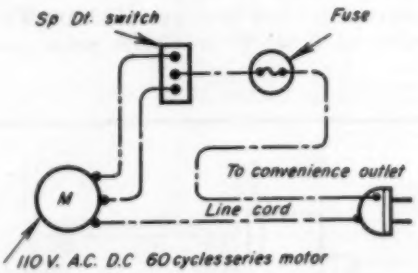


FIG. 6. SIMPLE electric circuit for controlling the fractional horsepower pump motor.

About the Authors

Edward L. Bronstien, is a graduate of Massachusetts Institute of Technology. Before joining The United States Bedding Company as a production engineer he worked for the Atomic Energy Commission.

Richard A. Fisher is a design engineer and holds a degree from the University of Minnesota. Both men work on the design of machinery for the bedding industry.

THIRD

PRIZE •

JOHN E. MINTY
and RAYMOND L. OBER

Here's the story of a completely new industrial application for hydraulics. Oil powered operation of all motions on an overhead traveling crane points to superior performance at lower cost.

Design of a

FULL HYDRAULIC OVERHEAD CRANE

IN 1888 the first three-motored electric overhead traveling crane was designed and built by Alton J. Shaw in the city of Milwaukee. Although there have been many advances in crane design during the past 67 years, the principle has not changed at all—since one electric motor, necessary gearing and electrical control are necessary for each of the three crane motions—bridge, hoist and trolley traverse.

In 1926 one of the writers of this article was faced with the necessity for installing an invalid elevator in his home. After considering various commercial designs then available, he elected to build a hydraulic lift to be operated by city water pressure. This was done and it was an unqualified success due to its infinite variable speed control, its smoothness and silence. Being engaged in the design and manufacture of electric overhead traveling cranes, he decided to explore the possibilities of developing a hydraulic crane for industrial purposes.

He felt that if this was possible it would fill a desirable need in the industry for a low headroom, compact, simple, overhead crane with infinite variable speed control for industrial applications which would give superior performance and at lower cost. This three-ton crane shown in the photographs was built and put into operation this summer.

Though the idea was first conceived in 1938 and work was commenced at that time, circumstances prevented its continuance until the present. This is probably a good omen, since today the opportunity is at hand to take advantage of the great strides made in recent years, both during and since the war, in the development of all sorts of hydraulic mechanisms and their successful application, including pumps, motors, cylinders, valves and particularly ingenious hydraulic circuits. These tried and proven units are now available and well understood by the many competent hydraulic engineers and service men of today. This was not so in the later 30's when the idea of this hydraulic crane was first conceived. After much thought we have arrived at a design that is radically different in principle from the first multi-motored electric crane and which, to the best of our knowledge, is the first of its kind in the country.

We feel that this design is superior to the three-motored electric crane in certain capacities and heights of lift and from actual figures is lower in cost than a comparable electric crane. This lower cost figure shows up even in the first unit and will be bettered as volume increases. Many of the expensive and complicated details and parts necessary in any three-motored electric traveling crane are eliminated and simplification in structural design and mechanical details bring about this lower cost.

OVERHEAD CRANE

Infinite variable speed control on all three motions is a most desirable by-product of the application of these hydraulic principles.

The mechanical and electrical elements that the hydraulic crane eliminates are:

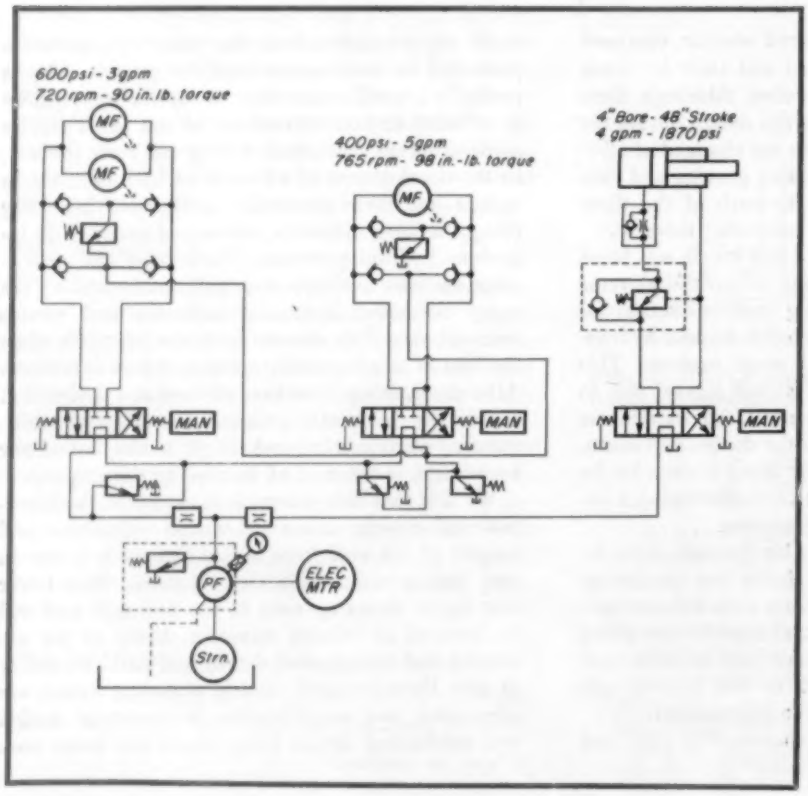
1. Cross shaft, 2. cross shaft pillow block bearing, 3. cross shaft pillow block support brackets, 4. bridge brake (either foot brake, hydraulic or solenoid), 5. the three wound rotor motors to power the hoist, trolley and bridge, vs. one squirrel cage motor, 6. three drum controllers vs. a simple line starter for the single squirrel cage motor, 7. three banks of resistance, 8. all cross wires, 9. current collectors for these cross wires, 10. hoist limit switch, 11. hoist solenoid brake, 12. hoist load brake, or equivalent electrical lowering control equipment, contactors, etc., 13. rope winding drum, 14. all hoist gearing, 15. the large trolley frame which is required to carry the present hoist and traversing machinery.

In addition, a considerable amount of machine work now required to produce winding drums, gears, shafts, pinions, keyways, gear cases, roller bearing cartridges, etc. is eliminated. Also, the assembly details for the hoist, for the traverse and for the bridge mechanism are greatly simplified. The bridge structure, because of this hydraulic hoisting and traversing design, can be modified radically from the usual design of two box girders, which must be spaced sufficiently wide apart to permit the rope to clear them when unwound from the hoisting drum. However, in this hydraulic crane bridge design, I-beam and/or plate girders can be used for any span since they will be latticed together across their tops and midway between their top and bottom flanges or chords, thus giving the combined structure ample lateral rigidity. Considerable weight is saved by this construction vs. the box girder design.

As the lift increases, the stroke of the hoisting cylinder increases, but as this is laid lengthwise with the girder, it eliminates the need for wider girder spacing. Incidentally, the hoisting cylinder can be placed on the outside of either girder, rather than between them as shown in this design, if even lower headroom is required. However, this introduces two additional sheaves which it may be desirable to eliminate.

TROLLEY DRIVE

The trolley traverse mechanism, consists of a hydraulic motor of suitable horsepower flange mounted to a spur or worm reducer, which in turn is coupled to a short shaft extending between the girders suitably located, so that either link chains (as used in this design or wire rope can be employed, the latter requiring the use of two wide-grooved sheaves or drums instead of the pocket wheels used for the chain. It will be noted that these chains and/or ropes drop down between the rail and the girder web, thus removing any unsightly sag. Two chains



STANDARD 2000 psi components are used in this circuit. Actual duty cycle of the system is small. Overall efficiency compares favorably with three motored electric traveling cranes.

are employed, one on each side of the trolley to make this support possible, though it is entirely feasible to use but one part of chain or rope, which would be attached to the center of the trolley, but in that case some visible sag would result.

POWER FOR THE BRIDGE

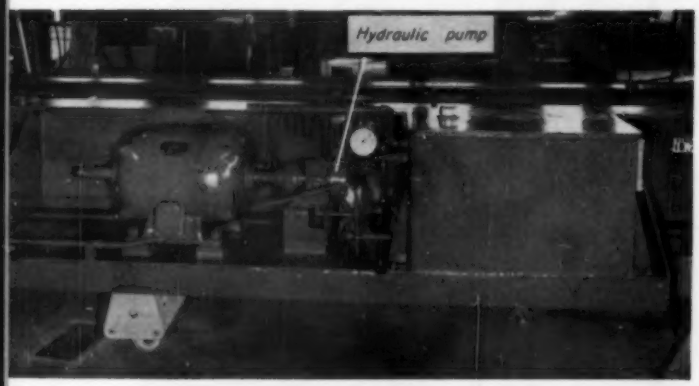
The bridge, is powered by two hydraulic motors of suitable horsepower, flange mounted to two spur or worm gear reducers, one of each mounted on the end trucks. In this design, roller chain has been employed to drive the bridge wheels bec ause of the ease of shop erection and alignment this design incorporates, but if desired it can easily be revised for either directly coupling the bridge wheel axles through a suitable gear reduction, or spur gearing can be employed to connect the output shaft of the reducer to the driver gear as the designer and/or the purchaser may elect.

HOIST CIRCUIT

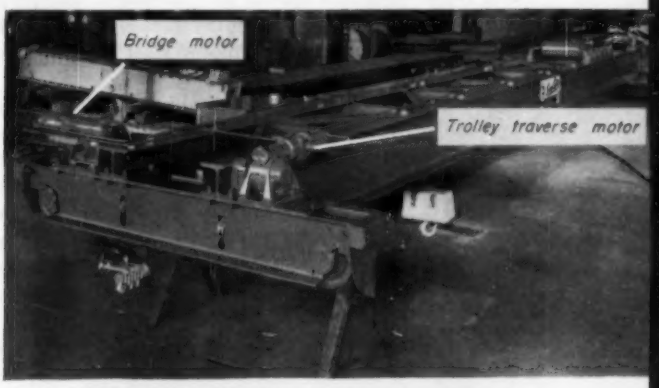
The hoist mechanism consists of a hydraulic cylinder, piston and rod, of sufficient stroke to provide the required lift. Six sheaves are employed on the movable cross head and the stationary cross head in such a manner that as the movable crosshead is extended a reverse ratio of 6-1 is obtained. As the bottom block is supported by four parts of rope, it is desirable to use a parallel rope reeving and since the six movable sheaves will give an inverse ratio of 6-1 and the bottom block must always hang in the bight of the line, a positive ratio of 2-1 results so the net overall mechanical advantage in the rope becomes 3-1. Thus, for every foot of stroke of the piston, the bottom block moves three feet.

Though in the design shown the lift required is only 12-feet which with this sheave arrangement requires a piston stroke of but 4-feet, higher lifts are easily obtainable. For instance, most industrial crane applications seldom exceed 30-feet in lift; and layouts have been prepared showing it is entirely satisfactory to employ a 10-foot cylinder stroke so that with this reeving a 30-foot lift is obtained.

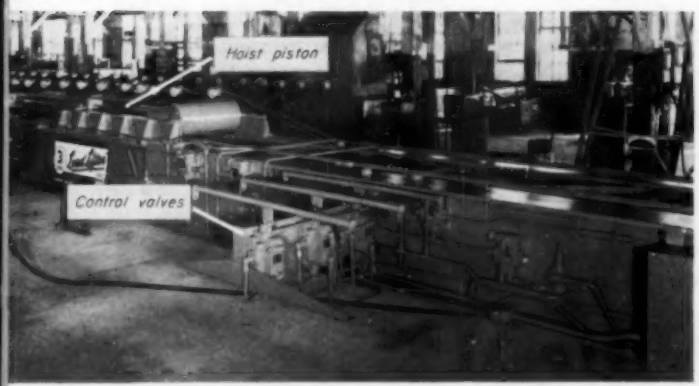
In this design, if a hoisting speed of 30 fpm is required, the piston speed with this reeving will be 10 fpm. Also, with this reeving the piston speed will be 1/3 of the hook speed and the piston rod loading



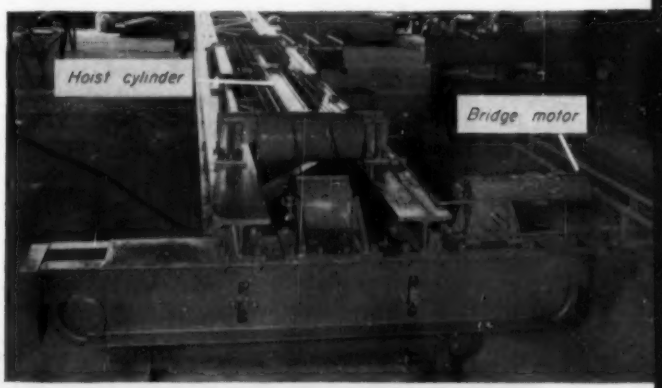
ONE 2000 PSI PUMP having a capacity of 12 gpm and driven by a 10 hp motor supplies power for all three motions on the crane.



ONE BRIDGE MOTOR and the trolley traverse motor are seen in this picture taken during the assembly of the crane.



HOIST PISTON is seen at the left. Three panel mounted directional control valves have special arms which will be operated from the floor by pendant cords.



TWO HYDRAULIC motors power the bridge, one at each end. Each fluid motor generates torque to drive the bridge wheels through a gear reducer and chain drive.

will be three times the hook load, plus a small amount for inefficiencies. The designer may utilize a variety of maximum pressures, cylinder strokes, cylinder bores, rope reeving, etc. to accomplish the results he seeks.

POWER AND CONTROL

In this hydraulic circuit we are using a single pump of the constant volume vane type, from which the flow is divided into the bridge and hoist operating valves, with flow control valves to limit the volume to each. The trolley operating valve is piped up in series with the bridge operating valve, so that the flow is through the bridge valve into the trolley valve.

The manually operated four-way valves are of the full throttling type with no detents, so that advantage can be taken of infinite variable speed control. and replaced with a special long arm and arranged for operation from the floor by means of pendant cords. The pushbutton for motor start and stop is also placed near the pendant.

Check and relief valves are used in both the bridge and trolley motions to give the braking action desired. A counterbalance valve is placed in the hoist cylinder line to prevent the load from dropping and a flow divider is used in the bridge circuit to equalize within limits the speed of the two bridge motors.

The three fluid motors are of the constant torque vane type.

For further cost reduction, the electric motor driving the pump was selected on a short duty basis; as although it may be running continuously for several hours, the actual time that it will be loaded to capacity will be small in comparison.

Most all electric three-motored cranes built today are powered with alternating current, using wound rotor motors. These motors, unlike D. C. motors, operate at approximately the same speed, irrespective of the load imposed on them, with the result that the hoisting speed in general is the same, whether the crane is loaded or unloaded.

With this hydraulic design, however, it is quite simple to make use of two pumps, one high pressure and low volume, in combination with a low pressure, high volume pump, both being driven off the same motor extension shaft. The circuit can then be so arranged that the pumps will be cut in and out automatically, depending upon the resistance imposed by the load on the hook, or it can also be accomplished manually. With either method, considerable time can be saved in crane operation by running the empty hook up and down at a high speed and then from zero to its designed maximum speed when under rated load—all with infinite variable speed control.

The overall efficiency of this hydraulic crane compares favorably with the efficiency of a so-called standard type, three motored electric traveling crane. On such a standard crane we would use a total of 10 hp in three wound rotor motors: 3 hp on the bridge, 1 hp on the traverse, and 6 hp on the hoist. However, on this new hydraulic crane our figures show a 7½ hp motor would be satisfactory, but as we intend to carry out some experimental work after the crane is erected and in operation (such as using two or more pumps as previously mentioned, etc. etc.) and due to the availability of a 10 hp motor, we felt it would be an advantage to have ample horsepower available. Therefore, we used it, although either motor would give the required speeds—the same as on the standard crane. These speeds are 175 fpm for the bridge, 100 fpm for the traverse, and 18 fpm for the hoisting speed.

We have provided a lower block of heavier-than-normal construction to keep the ropes taut when either hoisting or lowering with an empty hook.

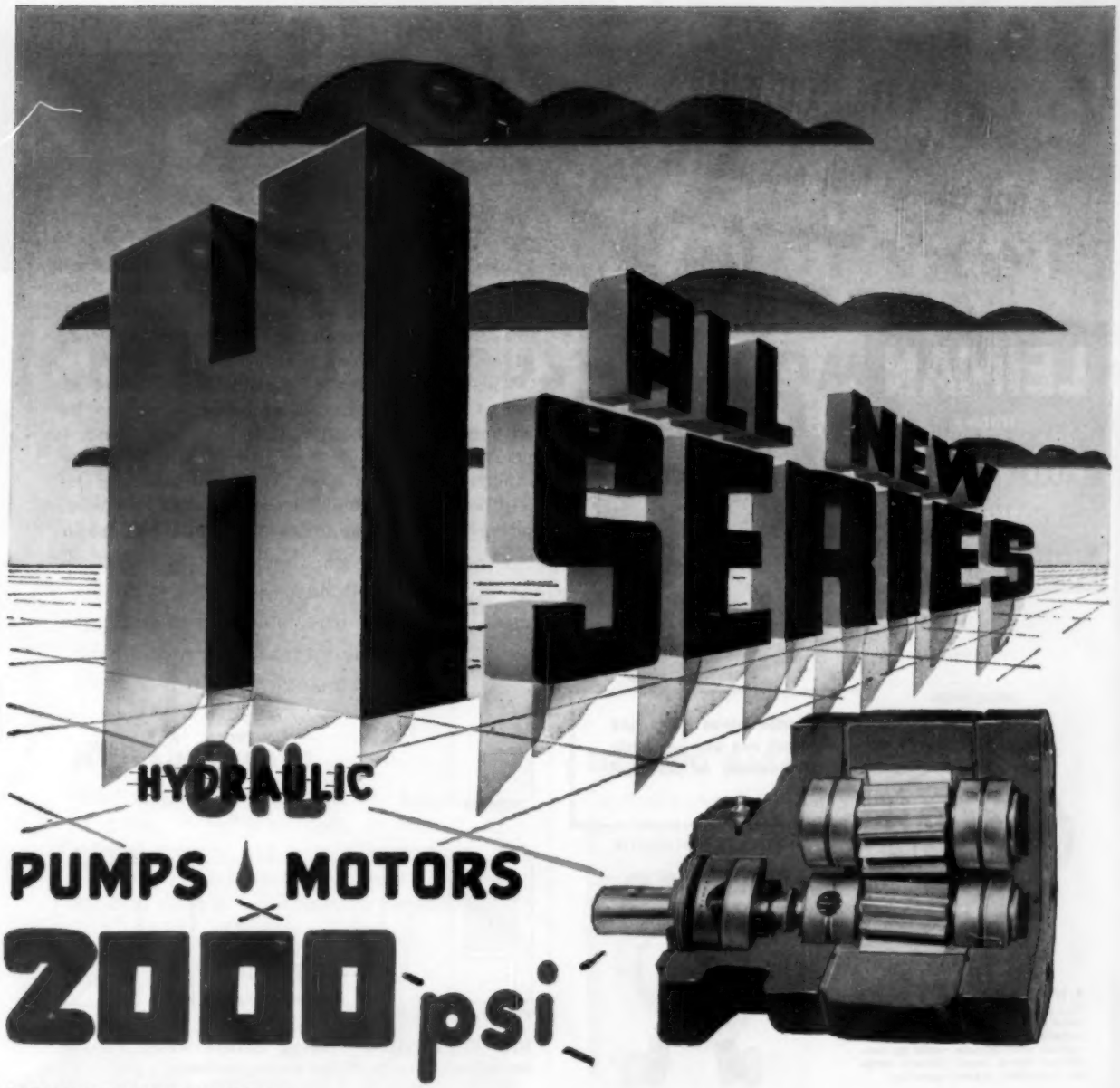
No matter what speed of hoist is used, there is never a problem with limit switches, as none will ever be required. The piston merely moves to the end of its stroke and stops, so that with the proper length of rope no damage can be done to the trolley nor will the rope become unwound or broken. The fact that no limit switches are needed is an appealing feature in itself.

Careful estimates for several cranes of spans in excess of 60-feet and of 10-ton capacity and of 30-foot lift, with a hoisting speed of 30 fpm show that a cost reduction in the neighborhood of 10% is possible. Furthermore, because of the low headroom feature and the infinite variable speed control easily obtained on all three motions, we confidently feel this new development will expand the use of hydraulic equipment in an entirely new field and have applied for patents on this device. ▼▼▼

About the Authors

Following his graduation from Cornell University in 1921, John E. Minty joined Shaw Box Crane and Hoist Division of Manning, Maxwell & Moore, Inc. He served an apprenticeship in the shop and later in the engineering department becoming chief engineer in 1928 and later, successively works manager and general manager, serving in the latter capacity for 20 years until 1950 when he became director of engineering.

Raymond L. Ober came to the Shaw Box Division in 1936 and has been engaged in the design of overhead electric traveling cranes, hydraulic drop tables and other special equipment.



NEW PERFORMANCE

continuous duty constant delivery operation—volumetric efficiency over 90%—7 sizes—single pump discharge 12 to 40 gpm*—single motor output 12 to 38 hp*

*(1200 rpm @ 2000 psi)

NEW DEPENDABILITY

extra large gear bearings maintain shaft alignment—special tapered roller outboard bearings absorb all drive shaft and shock loadings—new leakproof oil seals prevent leakage

NEW QUIET OPERATION

precision ground matched helical steel gears reduce noise, run smoother and are more quiet

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SAE standard flange or pedestal mounting—round or splined shafts—SAE standard side or end portings—threaded pipe or split flange connections—double rotation without alteration

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that take up their own wear!
No maintenance—no complaints—no shutdowns

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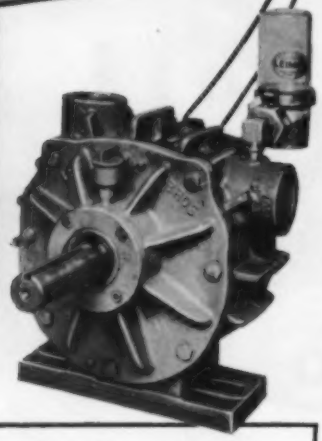
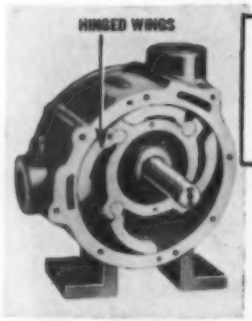
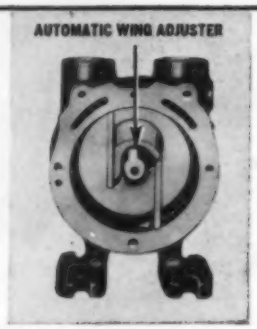
Rotary
AIR PUMPS
VACUUMS up to 29.9" Hg.
PRESSURES up to 20 lbs.





Patented Leiman Wings take up their own wear—maintain rated capacity for years and years.

4-WING TYPE. Vacuums to 20" Hg.; pressures to 15 lbs.; displacement to 162 cfm. Wings hinged to pistons maintain continuous sealed contact with cylinder walls by centrifugal force. Small pistons, large air chambers, greater capacity.



2-WING TYPE. Vacuums to 29.9" Hg.; pressures to 20 lbs.; displacement to 40.8 cfm. Automatic wing adjusting lever forces wear-resistant steel blades to cylinder walls, preventing sticking or binding, maintaining positive vacuum or pressure.

Even after 10, 15 and 20 years of continuous service, Leiman Air Pumps run extremely quiet and trouble-free—provide full, pulseless vacuum or pressure—require little or no maintenance, except lubrication. Precision-made with fewer parts, no packing, nothing to get out of order. Over half a million installed during past 60 years. Design Leiman dependability into *your* equipment. Consult our engineers on any application.

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AIR PUMPS • AIR MOTORS • SANDBLASTS • DUST COLLECTORS

POWER UNIT DESIGN

Continued from page 78

bers, we are able to use an 1800 rpm motor instead of the usual 1200 rpm, thereby using a smaller frame size and cheaper motor. One outstanding economy is in piping. By providing tapped holes to terminate and interconnect pipes the number of expensive hydraulic fittings is reduced to less than half. In addition by having all the connections on one side of the reservoir the time required to bend, fit, and connect tubing is reduced by one-fourth.

The larger number of possible combinations of pumps and valves has its problems as well as its advantages. For instance, it is possible to have a machine with ten of these power units, each one different in some respect. The Manufacturing Department and Assembly Department must have complete, lucid drawings to perform their functions in

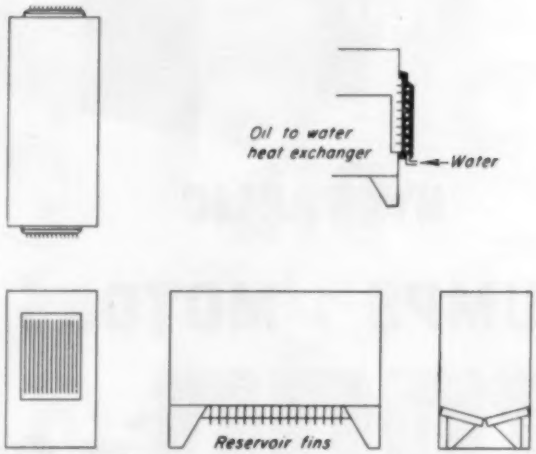


FIG. 8. POSSIBLE cooling devices which become an important part of the power package.

the most economical fashion. We have prepared, therefore, a number of main assemblies showing the physical appearance of the various combinations and having blank spaces for the part numbers of the variable components. The variable components may be a single part or a sub-assembly. Thus, by running a transparency of a suitable main assembly and by filling in the appropriate part numbers, we have a complete assembly that shows the finished power unit exactly as it is to be built. The same procedure is followed with variable details. By adding the different features on a transparency, we have the drawings we require. Thus, we can make use of our extreme flexibility without a great expenditure of engineering time.

Let us examine one final attribute which may seem unimportant in normal considerations, but which is most important psychologically. This is

Continued on page 90

Circle 84 on Reader Service Card

Circle 77

Keelavite

Solenoid-operated

PILOT VALVES

NEAT • ROBUST • COMPACT

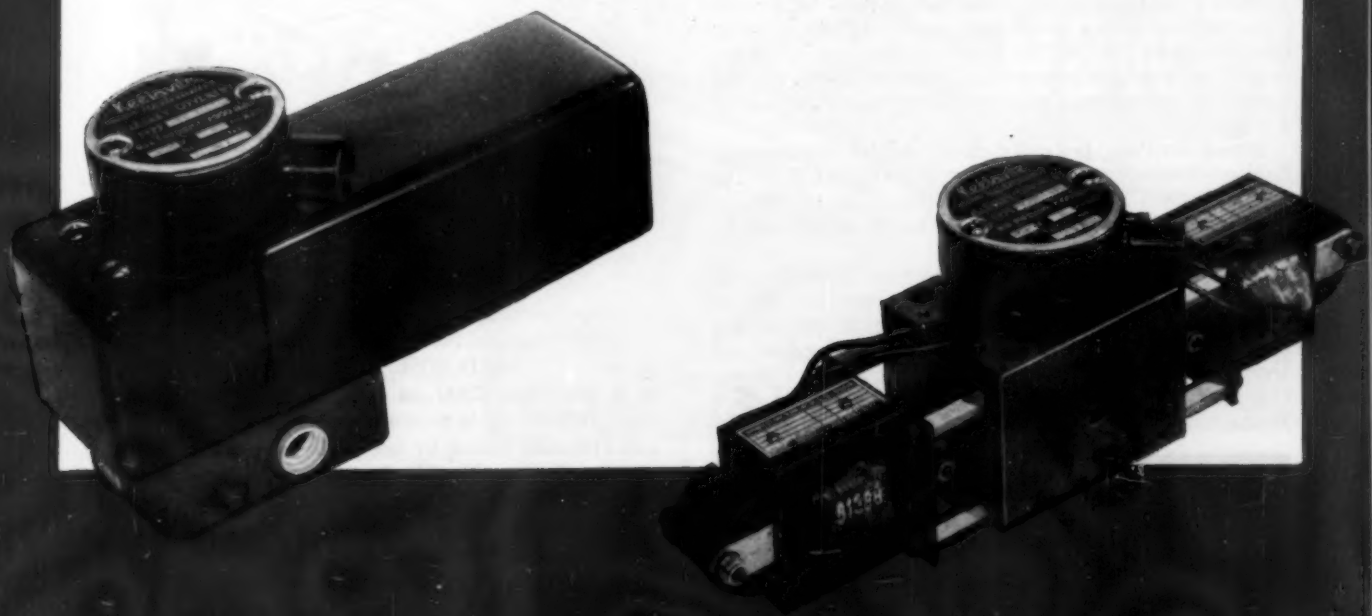
This new series of solenoid-operated pilot valves is a notable addition to the existing Keelavite range of sequence and interlock control gear. Its field of application in automatic hydraulic machinery is extremely comprehensive by virtue of the numerous alternative standard assemblies. Identical units may be used for electrically controlled piloting duties or small flow direction control. A further range can be mounted directly on to current Keelavite ¾", 1", 1½" and 2" directional valves to form a composite pilot-operated direction control unit. A gasket mounting type is available for attachment to other equipment.

HYDRAULIC DATA

Working pressure 2,000 p.s.i. • Rated Flow 1½g.p.m. • ¼" B.S.P. ports • Internal and external pressure and exhaust connections • Choice of several standard pistons • Send for data sheet giving installation dimensions.

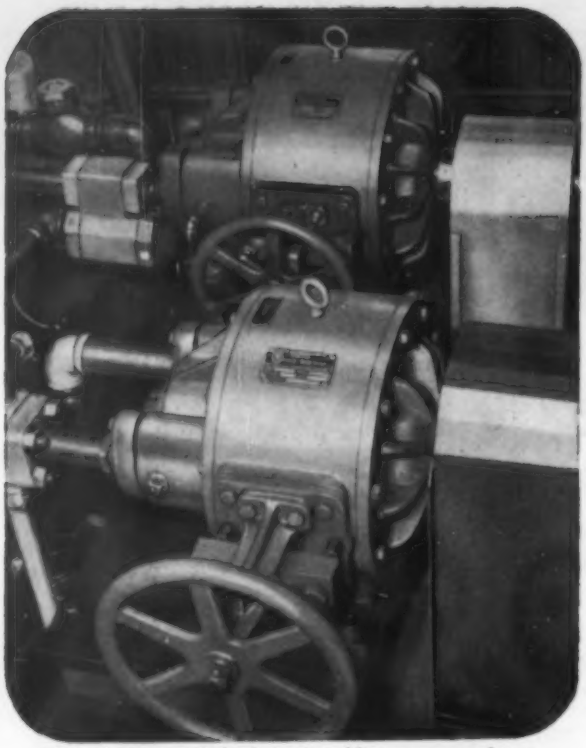
ELECTRIC DATA

Continuously rated solenoid • Single or double acting • 110-440 volt, single phase A.C. supply • Initial Load 350 v.a. • Closed load 60 v.a. • Terminal box rotatable through 360° • Solenoids housed in stove enamelled covers.



KEELAVITE ROTARY POWER & MOTORS LTD.
ALLERSHT. WORCESTER, ENGLAND

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION



Hydraulic power unit for Scripto's molding presses employs a JLP-18 Hele-Shaw and a JLP-12 Hele-Shaw, of 66 and 44 g.p.m. capacities, respectively. Both pumps have volume controls.

HELE-SHAW POWERS SCRIPTO MOLDING UNITS

SCRIPTO, INC., Atlanta, Georgia needed more efficient power for four plastic injection molding units used in producing the Company's famous Scripto pens and pencils ...so they installed a power unit employing two different size Hele-Shaw Pumps. The larger of these cuts in on the drop of accumulator pressure...if pressure still drops, the second cuts in and both recharge the system, at the rate of 110 g.p.m.

Hele-Shaw Pump is a radial-piston variable displacement fluid power generator for pressures to 3000 p.s.i. It can be readily applied to the machine it serves...is available in the right size, capacity and pressure for practically any requirement.

When ordering hydraulically-operated equipment, specify Hele-Shaw Pumps for top efficiency and service economy. Write for full information. Or, if you need a pump for constant displacement from 3 to 100 g.p.m., ask about the AE Hydramite. American Engineering Company, 2530 Aramingo Ave., Philadelphia 25, Penna.

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POWER UNIT DESIGN

Continued from page 88

the appearance of the whole power unit when installed on the job. It is a well known fact that an item with a pleasing appearance will receive better care than one one that has an unpleasing appearance. These days, functional simplicity of lines, cleanness and uncluttered shapes delineate the best looking pieces of machinery. Our power unit is built up of simple outlines. With the provision for connecting the pipes to the feed units, our power unit is uncluttered. The overall view connected to a machine is quite pleasing.

In addition, actual performance on the job has proved very successful as well as having tangible cost and space reduction features. ▼▼▼

FLUID POWER IN THE HOME

Continued from page 82

tubing was fairly thick black industrial hose. This is certainly not at all appealing in appearance to the housewife. Each Hydramatic Davenbed uses 67 feet of tubing, and even quotations in 500,000 foot quantities added up to more money than the pump and motor! We began a rather lengthy investigation of plastic and steel tubing. Due to the flexing and work hardening of metal tubing and the rather low burst pressure of vinyl and polyethylene tubing, we began experimenting with extruded nylon. After much trial and error and bursting many samples, we came up with a 3/16 O.D. tubing with a .025 wall capable of withstanding 2500 psi at approximately 4c per foot. This tubing is now on the market as commercial hydraulic tubing by one of the large nylon fabricators. It is reasonably flexible and has one very interesting feature. It is translucent. In assembling this Davenbed on a production line, the air in the tubing must be bled before final assembly. The air in the lines is very apparent through the tubing and any air lock or dirt is obvious. The worker immedi-

Our research department at work.

Continued on page 92

Call for Lindberg Red Cap!

A COMPLETE LINE OF AIR & HYDRAULIC CYLINDERS

Here is what to expect in a Lindberg RED CAP:

A rugged, dependable, long service cylinder that will do the job month in and month out. RED CAP identifies the famous line of Lindberg air and hydraulic cylinders, now made by Teer-Wickwire. These fine products are backed by expert engineering, made in a new plant equipped with latest type production machines, staffed by men schooled in precision work. New developments are in the works to extend the scope of our service to you. Expect big news from the Lindberg Air and Hydraulic Division of Teer-Wickwire!

AIR CYLINDERS

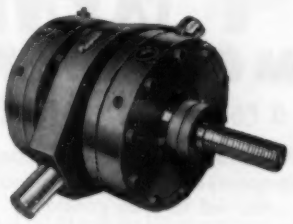
(low pressure)

For 150 p.s.i. maximum pressure. Bores 2" through 12" diameter. Heat treated aluminum pistons, cast iron cylinder caps and steel flanges. Retaining rings hold flanges to cylinder. Piston and rod packing, block "V" type.

HYDRAULIC CYLINDERS

(medium pressure)

For 1500 p.s.i. maximum pressure. Ten standard bore sizes, 2" through 8". Seven mounting styles. Standard rods or 2:1 differential rods available. Any length of stroke can be provided.



AIR CYLINDERS

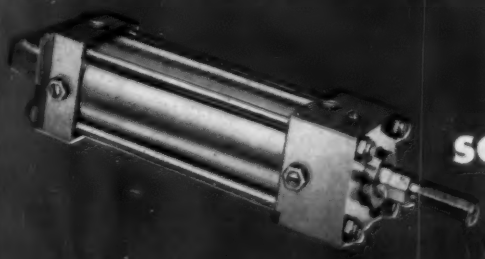
(heavy-duty, mill-type)

For 250 p.s.i. maximum pressure. Thirteen bore sizes from 3" through 24". Six mountings. Constructed of heavy hot rolled steel plate, welded. Strongest possible power unit.

HYDRAULIC CYLINDERS

(heavy-duty)

For 3000 p.s.i. maximum pressure. Ten standard bore sizes from 2" through 8" diameter. Seven mounting styles. Standard rods or 2:1 differential rods available. Cast iron one-piece pistons; steel plate end flanges arc-welded to tube.



NEW SQUARE HEAD TYPE CYLINDERS

Now in the final stages of production testing—new square head cylinders that will set new standards of usefulness.

Compact, cleanly designed, space saving, dependable. Will be available soon in a complete range of sizes and mountings.

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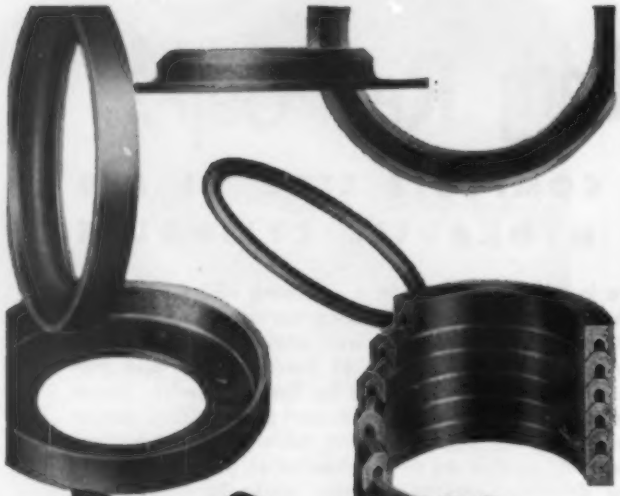

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Palmetto Molded Packings comprise a complete line that encompasses every design need. Designed for you originally ...refined for you constantly... they are always abreast of latest mechanical developments. Make your choice—for better product performance:

PALMETTO G-T® RING—For use as static or dynamic seal in hydraulic or pneumatic service. Seals without extruding or spiraling at all pressures to 20,000 psi. Simplifies design... reduces machining operations... minimizes overall size of equipment.

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PALMETTO O-RING—A popular seal for low and medium pressures. Simplifies design—saves space. Also recommended for gasket applications.

PALMETTO KUP—A popular piston packing available in a variety of fabrications to seal the standard or new synthetic fluids. More resistant to heat than leather... will not dry out in air.

PALMETTO FLANGE—For rod packing in low pressure service. Adaptable to reciprocating or rotary motion. Also used as dust seal.

and the NEW Improved

PALMETTO U-RING—New rugged design with wide lip flare for use in cylinders made from commercial tubing honed up to .030 over nominal sizes. Same sizes available in synthetic or fabric construction permits interchangeability of packing in low or high pressure cylinders. ALLOWS STANDARDIZATION OF COMPONENT PARTS... INCREASES EFFICIENCY... REDUCES FRICTION. ALSO RECOMMENDED AS ROD SEAL.

Solve your sealing problems with Palmetto Molded Packings. Avail yourself of special literature helpful to the design engineer... Write for Manual MP-200 today.

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packing more performance into every application

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FLUID POWER IN THE HOME

Continued from page 90

ately knows which of the eight lines (four on each port) contains air or foreign matter. In our early research where many bugs were encountered, this saved many hours of "head scratching". We are presently using standard compression fittings on the nylon as shown in Figure 4. We did, however, design a tapered serrated fitting which was extremely economical and reliable, but is still subject to further testing.

ELECTRICAL CIRCUIT AND SAFETY FEATURES

Figure 6 is a schematic diagram of the electric circuit showing a spring return toggle switch connected to the three wire reversible motor. The switch and fuse plate are mounted in the rear of the bed away from curious children. The spring return toggle also acts as an additional safety feature in that someone must be present when the bed is in operation. The bed is fused so that if the Davenbed is operated with someone sitting or lying on it, the pressure increases, the series wound motor draws more current, and the fuse blows. As we cannot be sure when a bed will be used as a window demonstrator, the fusing and the ruggedness of the entire power package had to be greatly over-designed rather than just assuming the bed would be operated twice a day. The maximum pump pressure is high enough to take care of the normal variation in the riveting of the steel leverage, and yet is not powerful enough to fold an unsuspecting sleeper up for the day!

A small hydraulic by-pass valve is also shown in Figure 3. This appeases the layman furniture salesman who has never seen a hydraulic piece of furniture and wants to operate the bed manually for any reason (e.g.—power failure). When this valve is opened, the oil circulated through the cylinders is allowed to return through the system.

Although considered a radical innovation in the furniture field, it is products such as this that makes the public and technical people alike more aware of hydraulics and its use as a labor saving source of power.

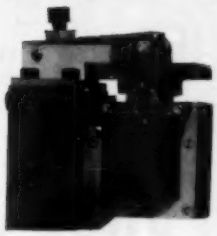
The miniature power package designed for this bed can be used to operate garage doors, windows, hospital beds and a host of everyday items which all can be made easier and more pleasant through the applications of hydraulics. ▼▼▼

What do you think about the possibilities for using hydraulic power in the home? Reliability is an important factor but certainly no more so than in industry and on aircraft. Operating time of hydraulic devices in the home would be very small, therefore, service life could be great. Can external leakage be eliminated? Will the benefits gained by the householder from using hydraulic power be great enough to convince him to buy?

WATERMAN CONTROLS

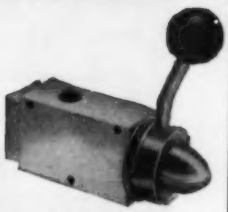
For accuracy–dependability–safety–low maintenance cost

SOLENOID VALVES



SOLENOID VALVES for working pressures to 3000 psi. Designed for remote control of hydraulic systems, and handling non-corrosive fluids. Poppet construction eliminates leakage. Impregnated coils are oil and moisture resistant. Available in 100-220 Volt A.C.

ADJUSTABLE FLOW REGULATORS



Full range Adjustable Flow Regulators from 0.5 GPM to 20 GPM. All Waterman Flow Regulators maintain a constant rate of flow regardless of work resistance or pressure fluctuations.

MICRONIC LINE FILTERS

Operating pressures to 3000 psi. 10 micron filtration. Replaceable elements. Available in 3/8" and 3/4" NPT.

CHECK VALVES

CHECK VALVES—one piece construction—no welds to crack. Nylon Poppet assures leak-proof service. Light weight aluminum body. Low pressure drop. Available in 3/8", 1/2", 3/4" and 1" NPT line sizes.

UNLOADING VALVES

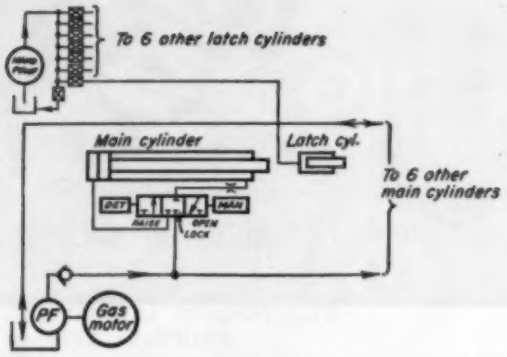
UNLOADING VALVES for system pressure to 3000 psi. Flow rates to 30 G.P.M. Fast acting, easily adjustable, maintain desired pressure settings without continuous readjustment. Hardened poppets eliminate leakage. Large passages assure maximum flow with minimum pressure loss.

Write for bulletin of any of these products

WATERMAN ENGINEERING COMPANY

725 CUSTER AVENUE • EVANSTON, ILLINOIS

Consideration for the "ship" captain has led to the application of hydraulics on sea going dump scows. Here's a new use for hydraulics which is designed to . . .



REMOTE OPERATION of the latch cylinders from the deck house takes the hazard and effort out of opening hopper doors on a dump scow.

Perform a BRUTE FORCE Job from a SAFE DISTANCE

• By D. G. Loomis

OUT in a heavy sea, the captain on most dump scows must go out of the deck house to release the hopper doors which hold his cargo of waste material. Old mechanical methods of releasing the doors require considerable effort to operate, and since speed of opening cannot be controlled, tremendous shock stresses are produced by the doors slamming against the hull structure. Also, there is a surge of water into the emptied hopper. This surge frequently causes the doors to slam closed with such forces as to cause damage to the doors and bulk head structure.

Moran Towing Corporation, New York City, recently added to their fleet two hydraulically operated dump scows which insure the safety of the captain, eliminate hard manual effort and provide controlled operation for shock-free hopper door action. These scows were built by the New York, Staten Island Shipyard of Bethlehem Steel Company. Design of the hopper door operating mechanism in-

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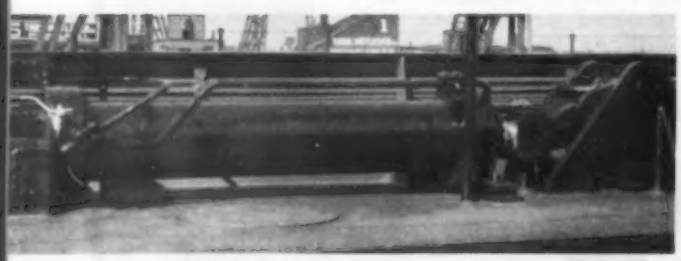
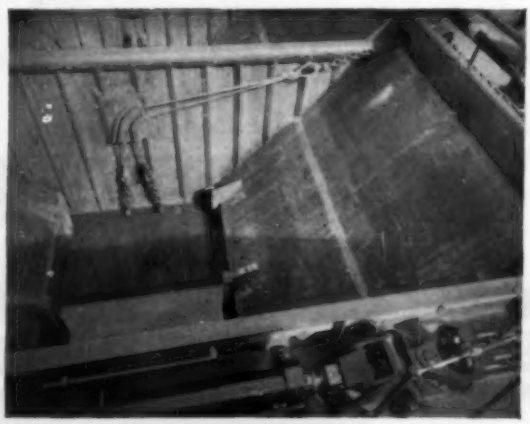
D. G. Loomis, *Loomis Engineering & Mfg. Company, Newark, N. J. This company designed the hydraulics.*



EACH of the seven hopper doors are raised by a large cylinder. During lowering, the cylinder acts as a dashpot.



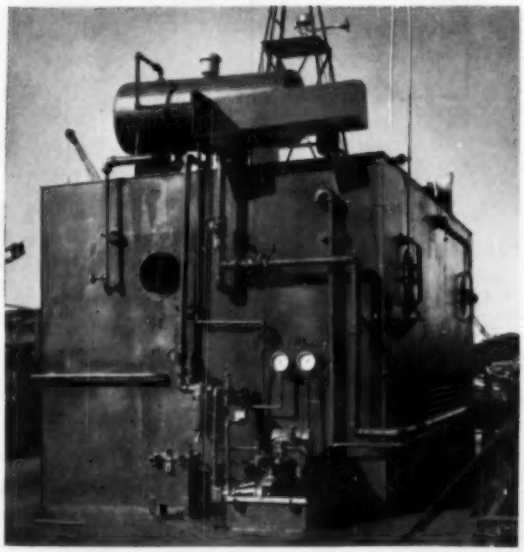
JACK KNIFE doors are cylinder operated through chain and cable. Each hopper can hold 200 tons of waste material.

FULLY LOADED, the scow deck will drop to within two feet of the water line. Remote controlled hydraulics keeps the captain in the deck house until the load is dropped and the scow rises about 12 feet.

volved the evaluation of several different methods. It was decided to use hydraulic cylinders to operate the doors and have an auxiliary latch to lock the doors closed and prevent accidental dumping which might be caused by oil leakage in the cylinder or valving.

The hydraulic system consists of two separate circuits: one for operating the main cylinders, and the other the latches. The main cylinder circuit has a reservoir, gasoline engine, hydraulic vane type pump, directional control valves and cylinders. Seven cylinders are used, one for each hopper. Each cylinder has a 10 inch bore and 62 inch stroke, and a 100 ton capacity. The reservoir is mounted on the top of the deck house to assure a hydrostatic head in all the lines under all conditions of scow loading.

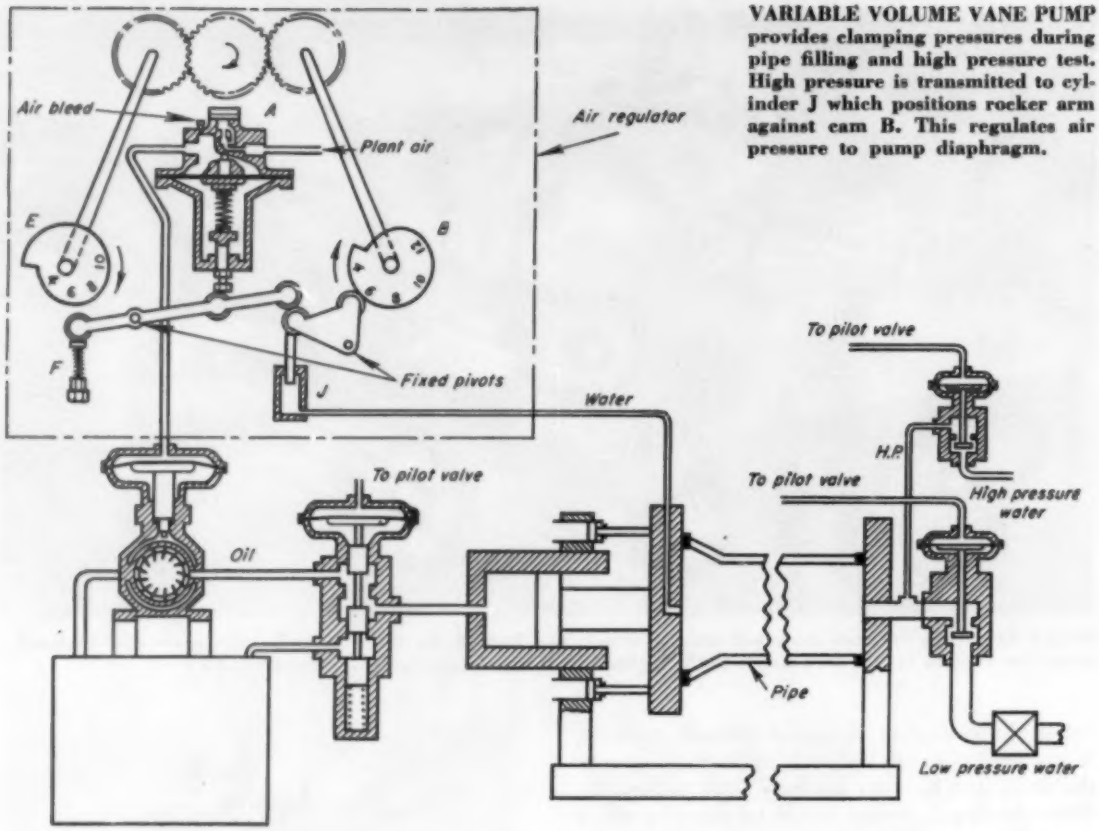
Operation of the hydraulic circuit is relatively simple. The main cylinder directional control valve has three positions: 1. Open, for unloading, 2. Lock, 3. Raise, for closing. In unloading, before the scow gets out to the open sea, the captain goes out on deck and shifts each of the seven directional control valves to the open position, which causes the load from the doors to be transferred to the latch. Out at sea, the actual operation is controlled from the deck house by opening the desired hopper manifold valve and operating the hand pump which releases the latch. Opening of the doors is retarded by the main cylinder. Oil flows from the piston rod end to the head end of the cylinder through a restricted passage. In this way, the cylinder acts as a dashpot. After the unloading has been completed, the scow deck has risen about twelve feet which allows sufficient height above the waves for the captain to go



GASOLINE ENGINE driven pump is located outside the deck house. An overhead tank assures hydrostatic head on all lines.

safely out on deck, start the gasoline driven pump, and shift the directional control valves to the raise position for closing the doors.

With oil hydraulics, it is possible to make installations requiring a minimum of expensive stainless alloys. Very few standard electrical or mechanical components can match oil hydraulic equipment in regard to their resistance to marine exposure. These characteristics of oil hydraulic systems should open many new applications in the marine field. ▼▼▼



VARIABLE VOLUME VANE PUMP provides clamping pressures during pipe filling and high pressure test. High pressure is transmitted to cylinder J which positions rocker arm against cam B. This regulates air pressure to pump diaphragm.

AIR REGULATOR CONTROLS OIL PUMP PRESSURE

. . . *in pipe testing equipment*

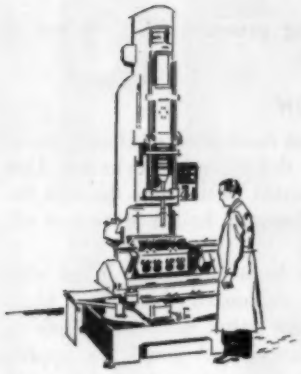
● By A. J. Roecker

Control of clamping pressure is critical for safe operation of hydrostatic testing machines. Here's an air operated control circuit for clamping pressure which uses standard air and hydraulic components.

IN hydrostatic testing of pipes, pressure to clamp the ends of the pipe must exceed test pressure inside the pipe. However the force required to clamp the pipe and seal the ends during high pressure test would bend the pipe at filling pressures. A pipe testing system, therefore, must correlate clamping pressure with pressure inside the pipe in all stages of the test.

A system was worked out by Florence Pipe Foundry and Machine Co. to incorporate these features

A. J. Roecker, *Hydraulic Engineer, Florence Pipe Foundry & Machine Co., Florence, N. J.*



"Power flow smoothed... reject problem solved"

A large Eastern manufacturer of pressed metal specialties was faced with the problem of erratic operation of the hydraulic presses . . . *resulting in a high percentage of rejected pieces.* Sinclair Lubrication Engineer Don Rigg was asked for his recommendation.

Vanes and valves coated

Mr. Rigg reports, "While examining the pumps, I found indications of lacquer deposits on the vanes and flow control valves *which interfered with the steady flow of power.* I recommended one of Sinclair's newly developed DURO Hydraulic Oils. This specially formulated oil offers additional protection against the formation of sludge and lacquers – permits smooth, positive transmission of power.

Test convinces customers

Mr. Rigg continues, "The customer introduced Sinclair DURO into several presses. After a trial period in which *outstanding results* were noted, the company decided to standardize on Sinclair DURO as their hydraulic medium."

Why not give a Sinclair Lubrication Engineer the chance to help solve your lubrication problem. *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N.Y.

SINCLAIR LUBRICANTS

when testing various sizes of pipe. The system was designed for speed of operation and minimum duties for the operator.

Clamping pressure is developed by a variable-volume vane pump which is controlled by a diaphragm. Air acting against the diaphragm is controlled by the air regulator which is supplied with shop air. The pressure at which the pump will reach neutral position is proportional to the air pressure on the diaphragm. Low and high pressure water is supplied by the pipe for filling and testing.

AIR REGULATOR OPERATION

Clamping pressures during filling and testing are preset together by turning the center gear of the air regulator. Cam E fixes clamping pressure during pipe filling and Cam B fixes clamping pressure during high pressure test.

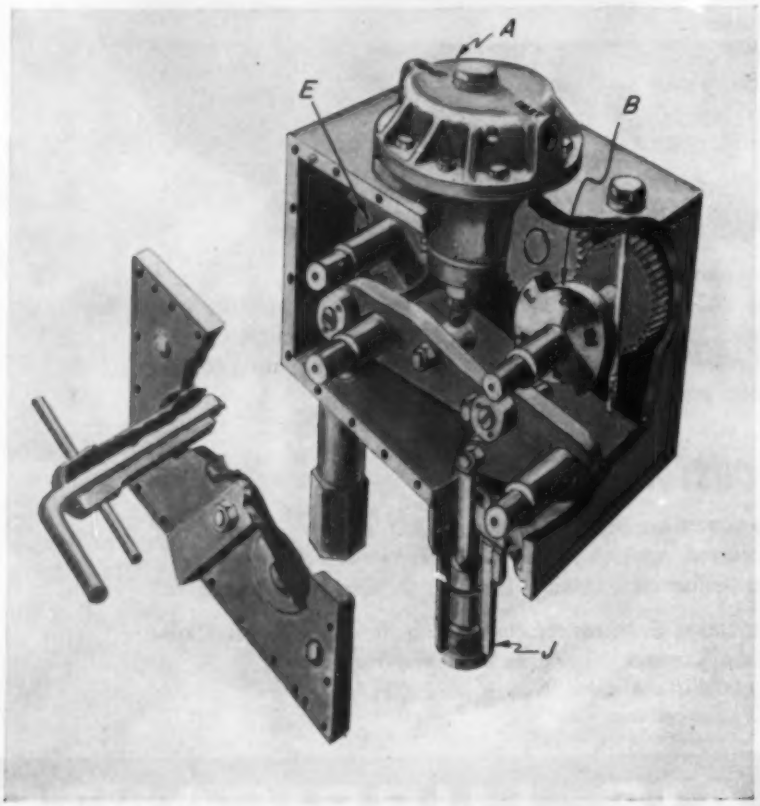
Cam E rotates the rocker arm from a horizontal position to depress the spring of the air valve. This allows air pressure to load the pump diaphragm fixing the pressure at which the pump reaches neutral position. The air valve A is a constant bleed-off type which allows the valve diaphragm to return with decreasing spring pressure. The amount of bleed-off is very small.

SYSTEM OPERATION

With the 3-way valve deactuated as shown, pump output is directed to the clamping cylinder. Low pressure water is admitted to the pipe through the gate valve and pump pressure builds up to just offset the filling pressure.

When the pipe has been completely filled with water and all air is exhausted through a bleed valve, the high pressure valve is opened applying full test pressure to the pipe. A small line applies pressure from the test fixture to cylinder J in the air regulator. This cylinder moves the rocker arm to the secondary position determined by cam B. Immediately, the air pressure on the pump diaphragm is increased, increasing the clamping pressure. Spring F on the rocker arm permits the operator to adjust when the cylinder will raise the rocker arm. When test pressure is released through an air operated valve, the 3-way valve is operated to direct the pump output to tank and remove clamping pressure.

The air regulator operates in an oil bath. All pins and cams are hardened and operate in roller bearings. The equipment has given trouble free operation for several years, and has provided the flexibility of operation which was required. ▼▼▼



AIR REGULATOR controls pressure on pump diaphragm adjusting pipe clamping pressure. Cams E and B position rocker arm during pipe filling and test. Rocker arm depresses spring in air valve A to control air pressure.

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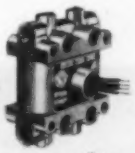
If you need precision control of gas, vapor, hydraulic pressure or vacuum 
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WORLD-WIDE REPRESENTATION — IMMEDIATE DELIVERY ON STANDARD VALVES

How will an O-ring stand up when used as a dynamic seal? Here's the experience of one user who changed the piston seals on a triplex pump.

PACKING GLAND REDESIGN

. . . reduces pump maintenance

• By Robert W. Cline

FORTY presses, in our rubber molding shop, are powered by a weighted accumulator system which is charged with water at 2000 psi from a triplex pump. Packing failure on this pump shuts down the operation of all the presses. If reliability of the packing gland can be improved so that maintenance can be carried out at regular intervals when presses are not scheduled for operation, there will be no loss of production time or spoilage of work.

The high pressure pump produces a flow of water by three pistons 1¼ inches in diameter operating with a 4 inch long stroke. A 20 hp electric motor drives a 3-throw crankshaft which reciprocates the pistons to give three equally spaced pressure impulses per revolution.

Figure 1 is a view of the pump with its cover removed to show the three pistons and crossheads. The motor and pump run continuously with an unloading valve controlled by limit switches operated by the accumulator position. The pistons are always pumping water but only under high pressure while the accumulator weight is being raised to its high position.

As purchased, the piston seals were of the conventional type, each consisting of 13 individual rings of packing stacked to 4½ inches in height and compressed in the gland by a screw-type packing nut. This gland is shown in Figure 2.

For approximately eight months, the pump operated satisfactorily with only minor adjustments. At this time, the pistons showed wear and required repacking. Subsequent intervals between repackings became progressively shorter and shorter; so that instead of sealing for 2 to 3 weeks, a set of packing would last but 2 or 3 days. And this took place in spite of the fact that new pistons were installed.

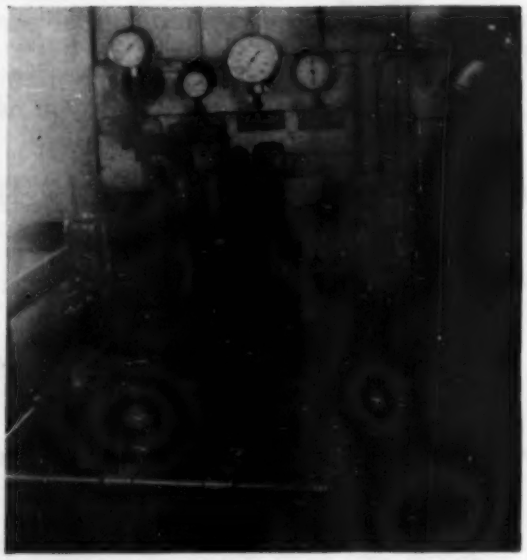

FIG. 1. TRIPLE-PISTON hydraulic pump which was converted to use O-ring piston packing.

Through many repetitions, the maintenance man in charge of this pump became expert at replacing packings; the entire repacking operation being done in 20 minutes per piston. This downtime represents considerable loss in man-hours and production. because pump failure usually occurred without much warning and caught many molds full of uncured parts which became worthless if pressure were released before the cure was complete.

Since repackings were required at intervals too short to permit scheduling them on week-ends when the plant was shutdown, a more reliable and longer lasting packing was desired. Many types of packing were tried; none of them performed well enough to be acceptable.

To insure continuous operation, a second high

ROBERT W. CLINE, *Design Engineer, Goshen Rubber Co., Inc., Goshen, Indiana.*

the "inside" story!

SILICON STEEL LAMINATIONS—give high efficiency.
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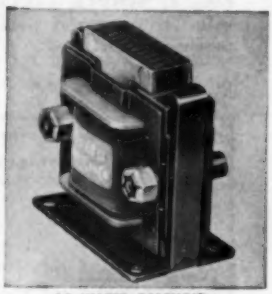
HEAVY SILICONE INSULATED MAGNET WIRE — wound on high flow point molded nylon bobbin.
TEMPERED STEEL SPRING — absorbs vibration — holds assembly firmly in alignment.

HORIZONTAL PUSH-TYPE WELDED BASE

VERTICAL PULL TYPE SHOCK-MOUNTED

VERTICAL PUSH-TYPE WELDED BASE



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pressure pump was installed. Because maintenance costs were still high, development of a better gland design was undertaken.

At first thought, the O-ring appeared too simple and inadequate—how could one ring of rubber only an eighth of an inch thick seal 2000 psi when 4½ inches of other packing has difficulty? Furthermore, how could it stand up under continuous operation to produce an acceptable life span?

TWO O-RINGS ARE USED

Figure 3 shows the O-ring gland which has increased the operating time between packing replacement. An adapter made of bearing bronze fills the space originally occupied by packing. A groove to contain the O-ring operating as a dynamic piston rod seal is turned on the inside of the adapter. Another groove to contain the second O-ring operating as a static seal to prevent water escaping around the adapter is turned in its outside diameter.

The inside bore of the adapter is turned to within .003 inch of the piston rod diameter and then relieved .006 inch more except for two 3/8 inch wide lands at the O-ring groove and one 7/16 inch land at the bottom. Thus, metal-to-metal rubbing area is relatively small and the useful life of a piston is lengthened considerably. The clearance between the adapter and the pump body is held to .005 maximum.

The dynamic seal has a 1.234 ID and .139 cross-section; it seals the 1.250 diameter plunger. The static seal has a 1.475 ID and .210 cross-section.

Because of the high pressure involved, a 90 Durometer A hardness Buna N material was selected over the ordinarily used 70 hard material.

No provision was made for supplementary lubrication, water alone being a good lubricant for rubber.

NEW GLAND IS FIXED QUICKER

One O-ring adapter was made and installed in the new pump, where it operated simultaneously with two sets of conventional packing. Results were good. The O-ring seal outlasted the other seals by a week or more.

For over two years, this lopsided setup was in constant operation. Not only lasting longer, the O-ring packing is changed in less than 1/3 the time—6 minutes instead of 20 minutes.

As a result of this extended testing, the remaining two cylinders of the new pump as well as all three cylinders of the old pump were equipped with the longer lasting O-ring seals.

One troublesome and unpredictable situation the O-ring has eliminated is that of jamming the pump valves with small pieces of packing that fall down into the valve chamber as the old packing rings are being picked out of the gland. Many times, immediately after repacking the pistons and starting the pump, it was shut down again and dissembled to free the valves. The single O-ring can be removed and a new one installed with practically no danger of loose pieces.

Nominal service life of the dynamic O-ring seal

Continued on page 104

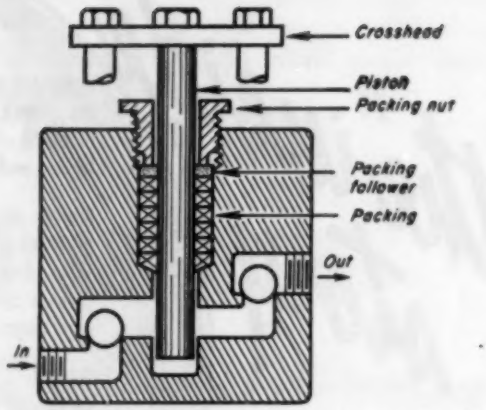


FIG. 2. TYPICAL high pressure water pump with conventional packing.

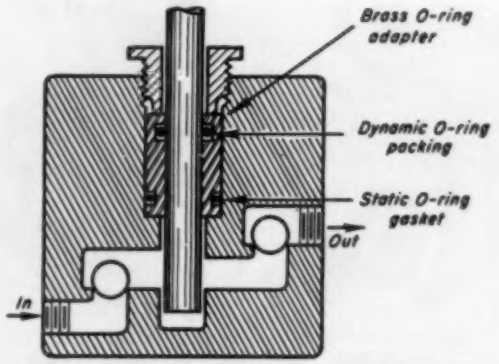
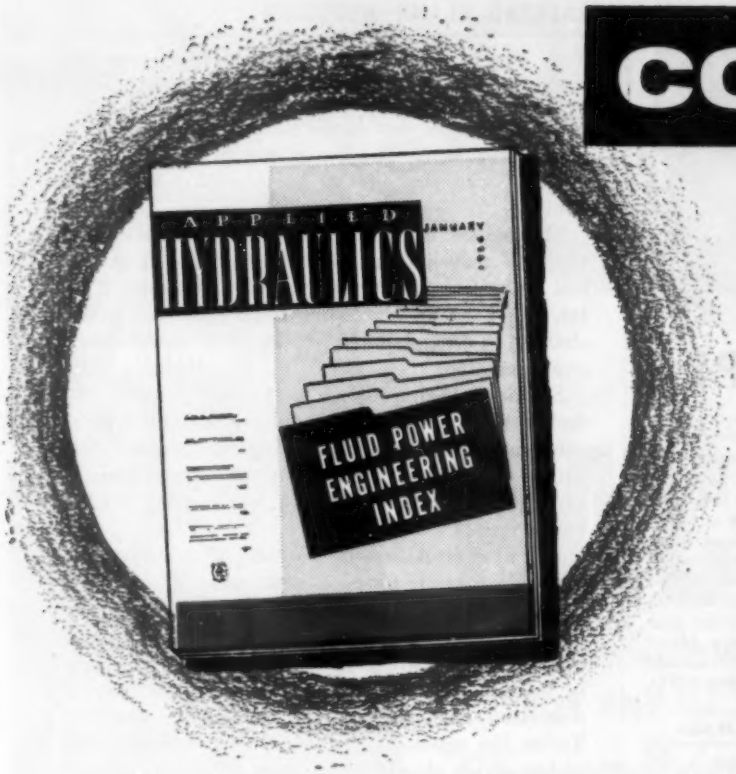


FIG. 3. SIMPLE CONVERSION to O-ring seals results in improved performance and lower maintenance charges.

TABLE I
Comparison of Repacking Costs

	Conventional Packing	O-ring Packing
Packing set	13 split rings	2 O-rings
Cost per set	$6.45	$.25
Time to install	20 minutes	6 minutes
Cost to install @ $3.00/hr.	$1.00	$.30
Yearly Activity		
Packing changes	8	6
Packing cost	$51.50	$.85
Installation cost	$8.00	$1.80
Total cost per pump	$178.50	$7.95
Savings in labor and material not including downtime loss.		$170.55
Adapter cost		$15.50

COMING!



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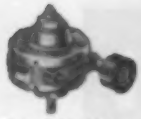

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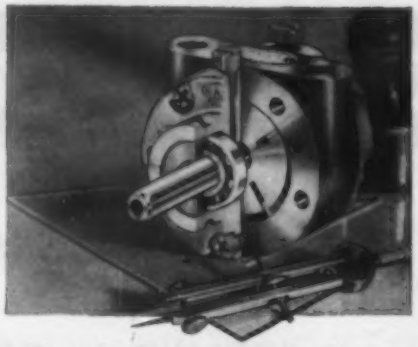

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See Our Catalog in Sweet's Product Design File

PACKING GLAND REDESIGN

Concluded from page 102

is 8 weeks, while that of the static seal is a year, or more. Repacking is no longer a costly, production-stealing operation; it can be scheduled with certainty.

The figures in Table I show that it was worthwhile to redesign the high pressure pump piston seal to utilize an O-ring. While performance, so far, has been an acceptable improvement, further changes in design should provide even more attractive economies.

Standard O-ring design practice recommends that in those applications involving hydraulic pressure above 1500 psi, the O-ring be supplemented with anti-extrusion rings. That recommendation is expected to be followed in a forthcoming design improvement.

An anti-extrusion ring consists of two turns of Teflon in a circle practically the same diameter as the O-ring. The O-ring groove is made longer so that a Teflon ring can be assembled on either side of the rubber ring where they act to prevent extrusion of the rubber into the clearance gap. This reduces distortion and wear of the O-ring. In addition, Teflon has a polishing action on the sliding metal piston which should result in appreciably lowered operating friction and wear. It is expected that O-ring seal life will be approximately doubled.▼▼▼

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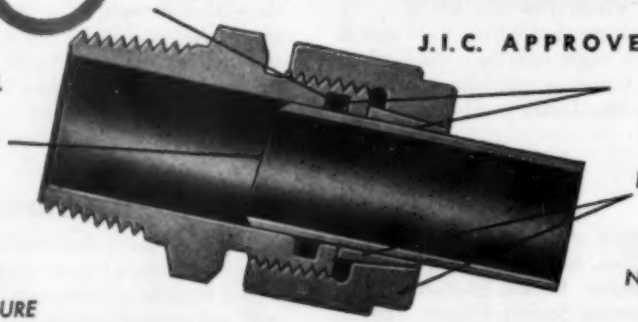

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O-RING MAINTENANCE

• By R. G. Dempsey

THE most practical fluid-sealing device developed to date is the O-ring packing which affords an excellent seal over wide ranges of pressure, temperature, and movement, with the added advantages of sealing pressure in both directions and having low running friction on moving parts. The O-ring packing has been successfully used for most static and dynamic seal installations, and its round cross section simplifies manufacture, design calculations, standardization, and installation.

Numerous variables which affect performance of O-rings might indicate that the performance and service life of these packings would be limited. As a matter of fact, the opposite is true, since O-ring packings have performed very satisfactorily over a wide variety of operating conditions.

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	No. 1	No. 2	No. 3
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Nose Gear Assembly	12,000	10,000	8,000
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Wing Flap Operating Cylinder	6,000	10,000	7,500
Pressure Regulator	6,000	6,000	9,000
Accumulators	9,000	6,000	O.C.*
Tail Skid Cylinder	8,000	10,000	8,000
Landing Gear Control Valve	8,000	10,000	8,000
Nose Gear Steering Cylinder	8,000	10,000	8,000

*On Condition

When an O-ring is installed between reciprocating or rotating members, it seals in the same manner as stationary packing. When the direction of pressure is changed, with a resultant change of direction of the piston, the packing will move to the opposite wall of its groove, as long as the fluid pressure force is greater than either the frictional rolling couple tending to roll the O-ring packing or the frictional forces retarding the sliding of the packing. In one case it will roll, while in the other it will slide to the opposite wall of the groove, depending upon the relationship of the resisting frictional forces. Friction of moving O-rings depends primarily upon packing compression, fluid pressure, and projected packing area exposed to pressure. The effects of materials, surfaces, fluid types, and speed of motion are also contributing factors.

This is readily evident when we examine the normal overhaul periods which have been established by three of the major airlines for various components of the aircraft hydraulic system. Overhaul periods for both mineral oil and synthetic systems are basically similar and are determined by the operator to fit into the scheduled overhaul.

BACK-UP DEVICES

The principal failure of high-pressure O-ring packings is extrusion of the packing material into the gap formed by the clearance between the piston and cylinder.

The rubber tends to extrude into this space, under pressure, in direct proportion to the pressure ap-

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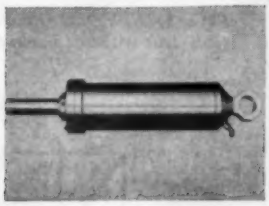
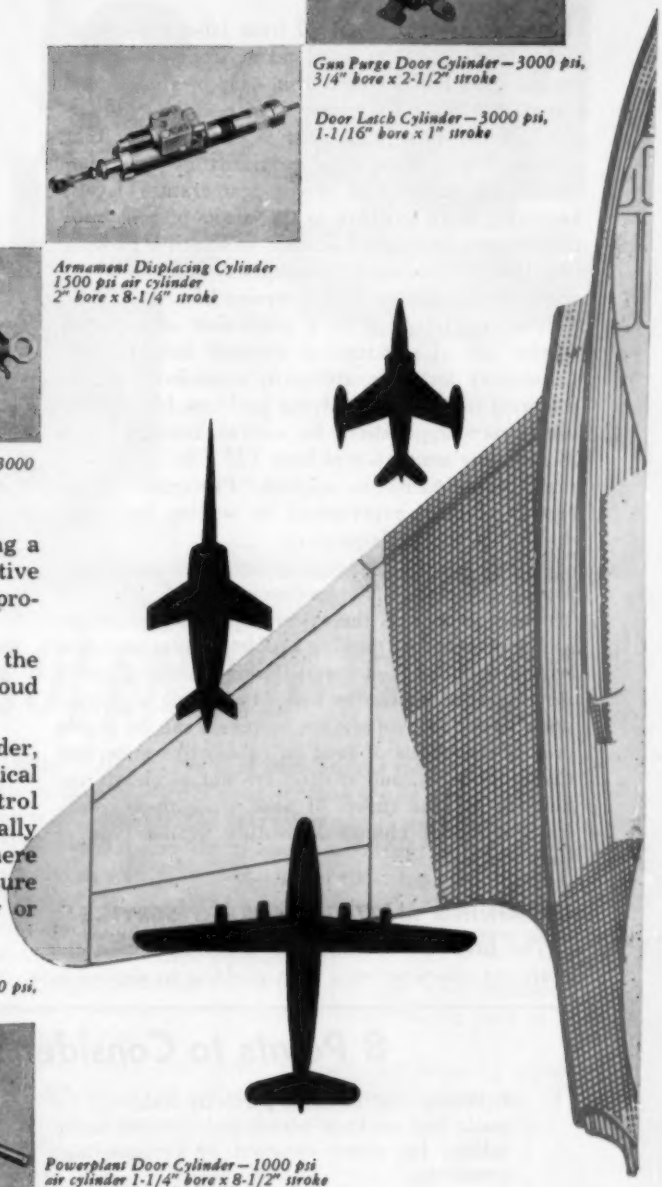
Gun Purge Door Cylinder – 3000 psi, 3/4" bore x 2-1/2" stroke

Door Latch Cylinder – 3000 psi, 1-1/16" bore x 1" stroke

Armament Displacing Cylinder 1500 psi air cylinder 2" bore x 8-1/4" stroke



M.L.G. Actuating Cylinder – 3000 psi, 6" bore x 17-1/2" stroke



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The ability to produce the smallest to the largest, the simplest to the most complex cylinders has made Loud top source for high quality – low priced units.

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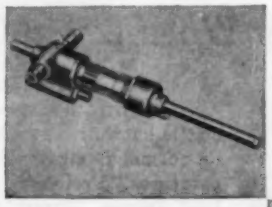
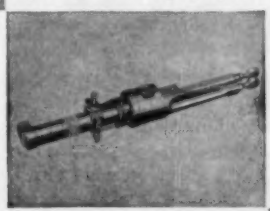
Aileron Booster Cylinder – 1500 psi, 1-9/16" bore x 6-1/8" stroke



Powerplant Door Cylinder – 1000 psi air cylinder 1-1/4" bore x 8-1/2" stroke w/mech. locks at both ends of stroke



Nose Gear Door Cylinder – 3000 psi, 1-3/16" bore x 7" stroke

Nose Wheel Steering Cylinder – 3000 psi, 1-1/4" bore x 6-3/4" stroke

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of operation" were obtained from laboratory data, and minimum values were taken from aging test results (300 F plot) and from examples of known service life for infrequently used packings (160 F plot). From this illustration it can be seen that packing life is determined primarily by wear and mechanical stresses at lower temperature levels, becoming more sensitive to the effects of heat until temperature becomes dominant in limiting packing life. The chart shows the discrepancy between laboratory results and estimated service life.

It is not intended as a prediction of expected service life of packings at elevated temperatures. Laboratory tests are ordinarily considered an accelerated means of qualifying packings for aircraft use in many applications for several thousand hours in the lower temperatures from 120 F to 160 F normally experienced in aircraft. Practically every type of failure experienced in service has been duplicated in the laboratory.

Extrusion is the principal cause of failure of high pressure O-rings. The tendency toward extrusion becomes greater as the system operating pressures are increased. Any packing problems encountered in service should be interpreted with caution. Usually the increased tendencies toward cracking and compression set as temperature increases can be attributed to the effects of heat on rubber-like materials. Chew, abrasion, and erosion are not as clearly defined as are the effects of heat, since these conditions normally change according to the type of back-up used.

OBTAINING MAXIMUM O-RING SERVICE

The first rule to follow in order to obtain the optimum characteristics of a packing in service is

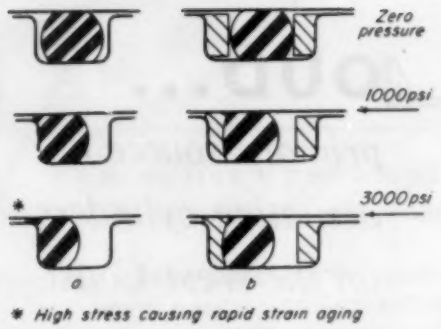

FIG. 1. EFFECT OF PRESSURE on O-ring packing with and without back-up ring.

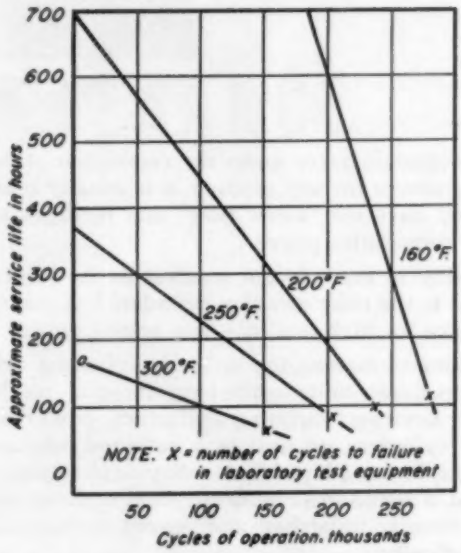

FIG. 2. RELATIONSHIP between cycles of operation and service life of O-rings at various temperatures.

8 Points to Consider When Using O-rings

1. O-rings can be made perfectly leakproof for static and dynamic piston and cylinder applications for either constant or variable high pressures.

2. O-rings must be radially compressed between the bottom of the packing groove and the cylinder wall, for proper sealing action.

3. The design of the packing groove must allow the packing to be properly compressed, and provide room for the compressed material to flow, so that the packing is not solidly confined between metal surfaces. Excessive freedom to move is not desirable; it is a necessary evil to accommodate manufacturing tolerance.

4. Sharp corners on the edges of packing grooves provide a knife-like edge which can whittle the extruded packing material, especially under pulsating pressures.

5. At extremely low temperatures, a well designed synthetic rubber packing may become brittle but will continue to seal and will resume its normal flexibility at normal operating temperatures. Prolonged exposure to excessive heat causes permanent hardening and will usually destroy the usefulness of the packing.

6. The packing material and hydraulic fluid must be compatible.

7. O-rings are extremely dependable because of their simplicity and ruggedness. Static seals will seal at high pressures in spite of a slightly irregular sealing surface or slight cuts or chips in the packing.

8. Cost of replacing O-ring packings is exceptionally low, at least as low as any other reliable type of seal.

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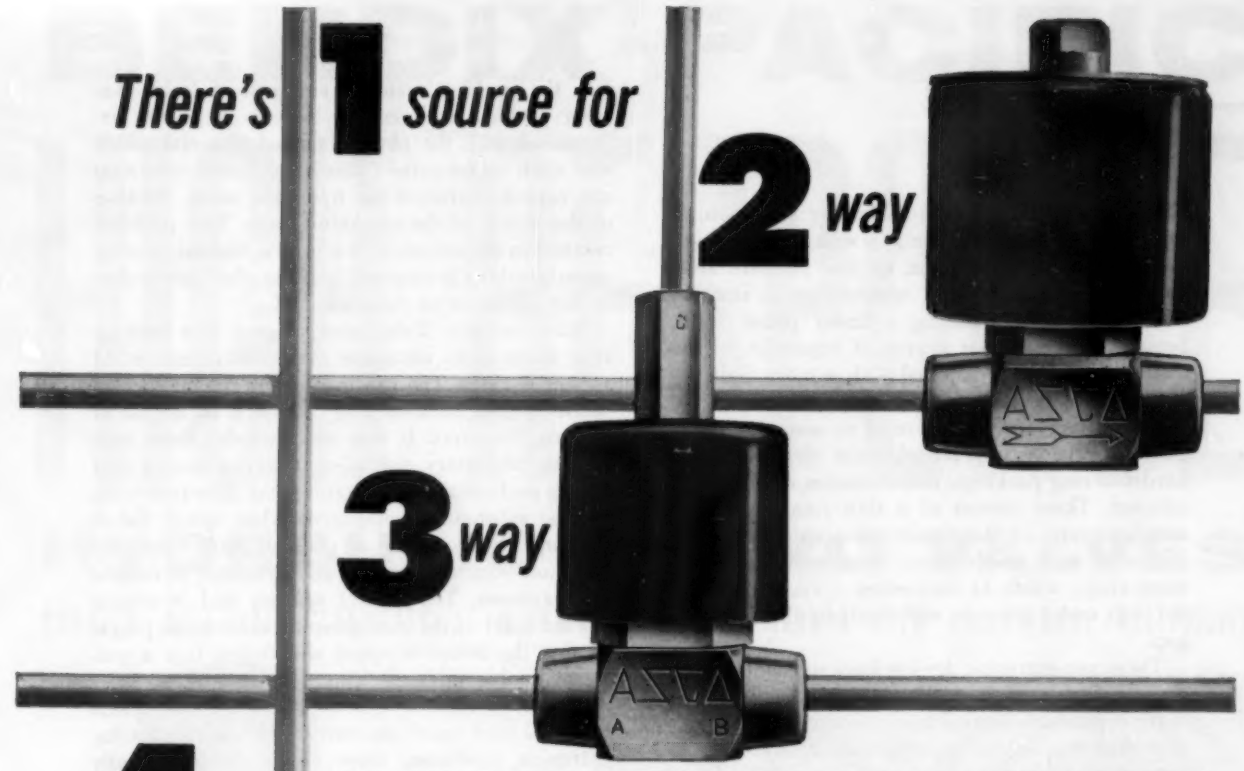

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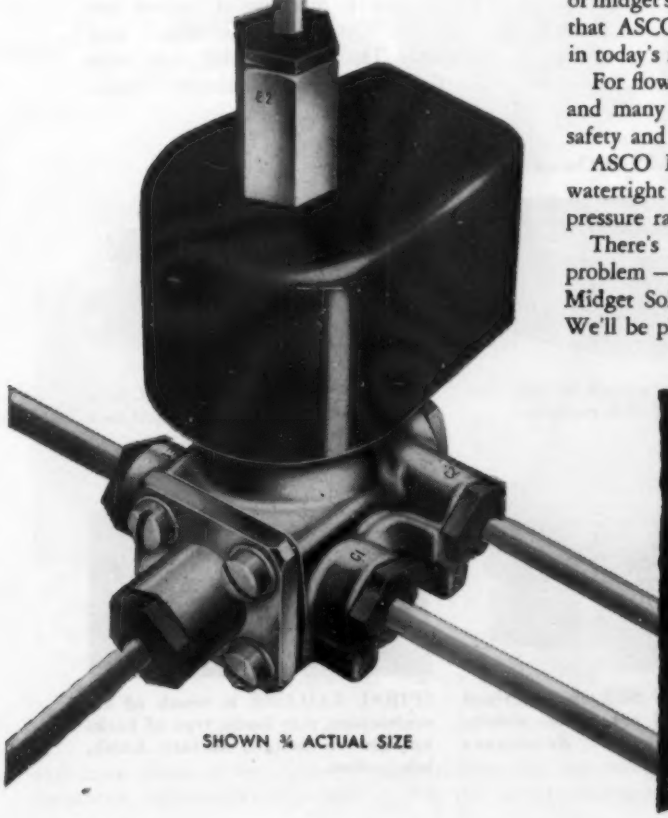

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plied. When a seal begins to fail by extrusion, it rotates slightly to cover the gap with new material, usually on the downstream or low pressure side. Extrusion is usually more apparent on an installation such as an actuating cylinder piston head, because of the greater degree of expansion of the cylinder barrel as compared with a more rigid installation such as a valve body. In order to increase the operating pressure of an assembly, without resorting to impractical, close clearances and harder O-ring packings, non-extrusion devices were adopted. These consist of a thin ring of leather, metal, or one of the numerous plastics currently available, or a combination of more than one of these rings, which fit themselves against the cylinder wall under pressure and eliminate the extrusion gap.

These non-extrusion devices have substantially increased O-ring packing life, and have ensured far more dependable service from the elastomeric packings than was originally obtainable. However problems were experienced in obtaining a suitable back-up material with low friction characteristics which would be resistant to hydraulic fluids, extrusion, heat, and hardening. The original and widely used back-up material was leather. In some instances this became hardened from constant usage, and formed a sharp or feathered edge on the outer circumference of the ring which eventually cut or chewed into the packing material and caused leaks. Another problem with leather back-up rings was experienced with the chrome tanned material which was often under-cured. This under-cured condition has caused corrosion on hydraulic units, because of the action of the chromium salts. This problem resulted in the adoption of a brown, chrome, leather material which is retanned in oil to eliminate undercuring all traces of chromium salts.

More recently, Teflon was adopted as a back-up ring material to eliminate the abrasive action on rubber O-rings. The continuous spiral construction of the Teflon back-up ring allows it to adjust to various diameters. It may be concluded from continuous laboratory and aircraft service testing that O-ring performance, endurance, and chew-resistance will be substantially improved when spiral Teflon back-up rings are used in place of leather back-up rings on both mineral oil and synthetic hydraulic fluid systems. The correct spacing and 30-degree inward scarf of the ends permit the center to joggle so that the complete spiral will flatten into a uniform, double thickness ring.

Numerous tests have been conducted on various all-metal back-up configurations. While eliminating extrusion problems, these configurations usually produce high frictional drag and excessive O-ring wear.

This article is based on material which appeared in DOUGLAS SERVICE.

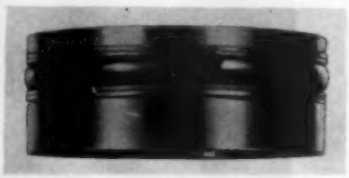
O-RING FAILURES

An interpretation of the various factors which determine packing life at elevated fluid temperatures is indicated in Figure 2. Mechanical factors are lumped together as "Cycles of Operation" and plotted on the x-axis. The point-to-point plots were obtained primarily by inference. Maximum "cycles

FIG. 3. EXAMPLES of O-ring failures.

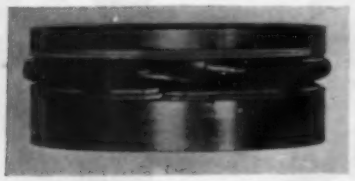
HIGH SWELL or volumetric change is generally accompanied by high frictional drag.

CHEW usually occurs in the low-pressure side of rod packings.



EROSION is usually confined to a small localized section adjacent to a break in back-up support.

CRACKING is caused by molding imperfections, repeated internal stresses, and elevated fluid temperatures.



COMPRESSION SET characterized by flatness and squareness results from excessive heat, decreases squeeze.

SPIRAL FAILURE is result of eccentricities, side loads, type of back-up, groove design, surface finish, lubrication.

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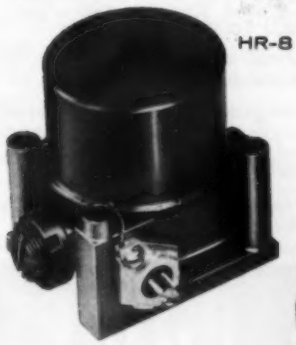

HR-8

HR-9

	HR-8	HR-9
RATED FLOW:	2.5 G.P.M. at 1200 P.S.I. Press. Drop and 6 MA(a)	4 G.P.M. at 3000 P.S.I. Press. Drop at 6 MA(a)
GAIN:	.66 G.P.M. Per MA(a)	.5 G.P.M. Per MA(a)
OPERATING CURRENT:	6 MA Quiescent	6 MA Quiescent
OPERATING PRESSURE:	1500 P.S.I.	3000 P.S.I.
LEAKAGE:	.15 G.P.M. Max. (None External)	.15 G.P.M. Max. (None External)
NATURAL FREQUENCY:	250 CPS	250 CPS
DITHER:	None	None
COIL:	Concentric Double Wound.	Double Wound. Equal Resistance Windings

HR-10

HR-11

	HR-10	HR-11
RATED FLOW:	4 G.P.M. at 3000 P.S.I. Press. Drop and 6 MA(a)	4 G.P.M. at 3000 P.S.I. Press. Drop and 12 MA(a)
GAIN:	.66 G.P.M. Per MA(a)	.33 G.P.M. Per MA(a)
OPERATING CURRENT:	6 MA Quiescent	12 MA Quiescent
OPERATING PRESSURE:	3000 P.S.I.	3000 P.S.I.
LEAKAGE:	.15 G.P.M. Max. (None External)	.15 G.P.M. Max. (None External)
NATURAL FREQUENCY:	250 CPS	250 CPS
DITHER:	None	None
COIL:	Double Wound. Equal Resistance Windings	Double Wound. Equal Resistance Windings

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O-RING MAINTENANCE

to keep the packing in the container as shipped by the manufacturer until it is to be used. It is extremely bad practice to arbitrarily dump packings loosely into bins, because of the hazard of potential damage. Elastomeric materials should be stored in a cool, dry place away from operating electrical machinery and exposure to sunlight. Many other considerations may affect the life and function of an O-ring packing, such as:

1. Type of metal employed
2. Metal surface finish or roughness
3. Packing gland design
4. Metal hardness
5. Breathing of cylinders or valve bodies
6. Pulse or surge pressures

On disassembly of a hydraulic unit incorporating O-rings, the following major inspections, replacements, and re-work as required should be performed to obtain a unit which is operationally as satisfactory as a new part.

1. Completely disassemble the unit in accordance with recommendations in the overhaul manual.

2. Inspect the packings and back-up device for evidence of compression set, chew, spiraling, cracking.

3. Check the hydraulic fluid for evidence of contamination.

4. Clean all parts thoroughly with an approved cleaning solvent.

5. Inspect the various components for general condition including surface finish, evidence of corrosion, score, or galling marks. Inspect all threads and chase any damaged threads.

6. Dimensionally inspect wear limits of piston and cylinder to determine if replating to the original blueprint dimensions is required to obtain satisfactory clearances between piston head and cylinder surfaces.

7. Inspect all metal scraper and lock rings for general condition and replace as required.

8. Replace all gaskets, packings, and sealing devices with appropriate replacement parts for the particular hydraulic fluid being used. Examine felt wipers and replace as required.

9. Cadmium plate external surfaces as required, if originally called for on the blueprint.

10. Reassemble the components using approved grease to lubricate threaded fittings and packings. Care should be exercised to prevent introducing excessive lubricant internally.

11. Test the complete assembly in accordance with the approved test procedure.

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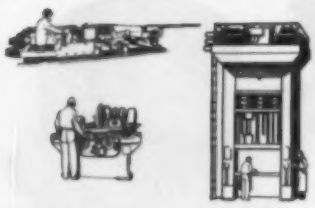

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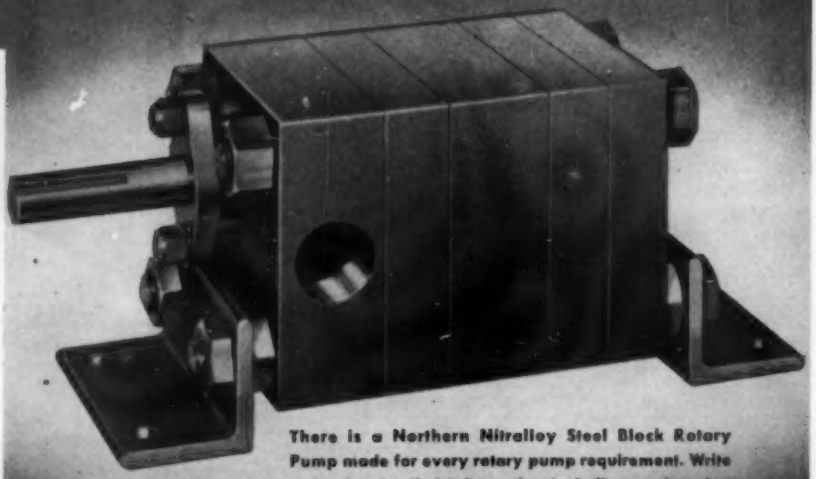

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7. Side loads
8. Speed of retraction or extension
9. Fluid contamination, or improper fluid-packing combination
10. Lubricating qualities of fluid on rubber-to-metal surfaces
11. Packing damage caused during installation
12. Excessive operating temperatures
13. Packings stored improperly or too long

Many packing failures are due to improper installation. Threads or sharp corners on ports, grooves, etc. over which the packing must pass while under compression during assembly can damage the packing. These considerations are taken into account during the initial design of the unit on which the O-ring is used. However the condition of the edges of all cross-drilled ports and any threaded portions of a unit that a packing must pass during installation should be inspected for freedom of burrs and for general condition.

Particular care must be practiced when installing a sleeve with O-rings in the outer circumferential grooves into a housing with drilled passageways. It is of the utmost importance that a lubricant be used when an installation of this type be accomplished. It is recommended that all packings be pre-lubricated prior to installation using either the appropriate hydraulic fluid used in the system or a mineral-base grease such as petrolatum or an approved grease for synthetic hydraulic fluids. ▼▼▼

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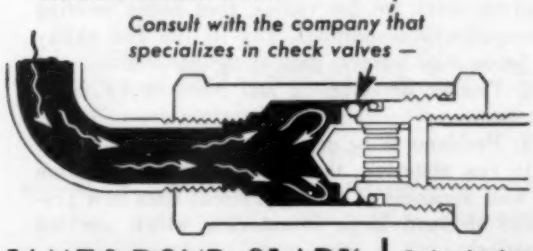

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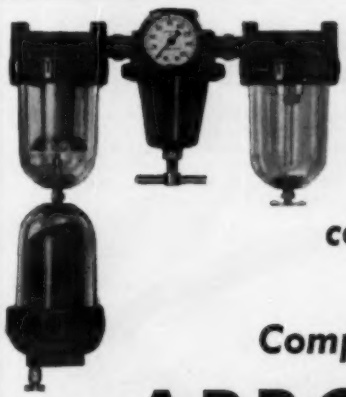

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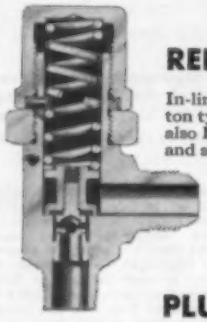

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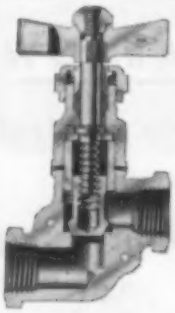

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SUMMARIES OF NCIH PAPERS

Continued from page 70

the output shaft during a gating time interval determined by pulses from the input shaft. Theoretically deduced error figures are compared with figures from laboratory measurement.

Methods for obtaining frequency response of the drive system are investigated. Two arrangements are considered. One uses the synchros feeding a differential synchro which drives a rotary potentiometer, the potentiometer applies a signal to an

M. G. Malmquist

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oscillograph; the other arrangement uses an electrical tachometer to generate the voltage for the oscillograph. The nature of the sine wave stroking mechanism is also considered. Results from laboratory measurement of a typical drive are compared with theoretically predicted results using a simplified linear mathematical analog.

Transient responses to small step inputs are measured using the same measuring equipment as used for the frequency response tests. Theoretically predicted response curves are compared with those obtained experimentally.

• PRODUCTION—HYDRAULIC TUBE FABRICATION

By Hugh H. Dorman, Powertube Engineering Co., Olivet, Mich.

1. The use and past history of tube fabrication in the hydraulic system.

Progress has been limited, but definitely sound, in the use of tubing in hydraulic systems. Different kinds of tubing have been tested, used, discarded, approved. Factors favoring its use above other methods are (1) It is less costly, (2) It can be bent on much smaller radius, thus better meeting "compactness" conditions, (3) Its life and ability to become an integral part of the basic unit.

2. Present development and research by fabricators.

3. Problems to be overcome in this field.

In raw materials, there must be standardization of wall thickness of tubing. Present sizes now produced demand large inventories, which are not practical.

Preparation of tubing for shipment is at present

Continued on page 116

Summerill Seamless Steel Pressure Tubing is made to specification to withstand far greater pressures than other commonly used tubing materials. It flares easily and takes sharp bends in stride without flattening or developing an "orange peel" effect on the bend.

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Standard drill press units converted for automatic push-button precision tapping and spot-facing operations. Production increase—400%!

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Pneu-Trol Flow Control Valves and Time Delay Control Switches are *basic automatic components* which permit low-cost conversion of any cylinder operated drill press, arbor press, punch press, etc. to automatic operation. They provide these advantages:

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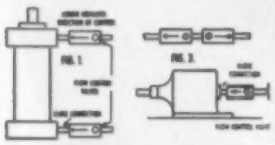
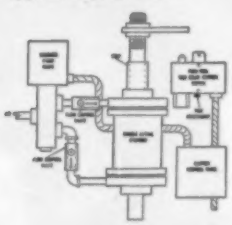
Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control, and a floating retro ball check, which permits full flow in the opposite direction. Design provides close regulation in one direction, full flow in opposite direction. Available in 5 female pipe sizes—⅛" to ½". Valve bodies made of brass, aluminum, steel or stainless steel.



TIME DELAY CONTROL SWITCH FOR PRECISE DELAY OF WORK CYCLE

Provide controlled adjustable time dwell of solenoid operated air or oil supply valves. Range between ¼ and 60 seconds in 20 to 1 ratios. Compact—simple—foolproof—rugged. Easily mounted on machine. Available for various types of actuation. Typical diagram below.



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Components for Automation
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SUMMARIES OF NCIH PAPERS

complicated and costly. There should be research and development of a product which would eliminate the many processes now necessary in tube fabrication.

• SWIVEL JOINTS AND THEIR HYDRAULIC APPLICATIONS

By James O. Heyworth, Sales Manager, Industrial Div., Barco Mfg. Co.

The paper on this broad subject covers five types of flexible, rotary or swivel joints which are fre-

H. H. Dorman

J. O. Heyworth

quently used on equipment such as machine tools, die casting machines, aircraft, earth moving equipment and power shovels, cranes, presses, pumps, etc. Each of the five types of joints provide a different type of movement and are as follows:

1. Plane Swivel Joints
2. Swing Joints—Single, Double and Triple
3. Self-aligning Swivel Joints
4. Flexible Ball Joints
5. Rotary or Revolving Joints

Design characteristics, pressure and temperature ratings, type of movement provided, with typical applications of each of these types of joints will be covered.

The use of Swivel Joints is predicated on a design requirement for movement in the piping, tubing, or other fluid conveying lines of a hydraulic system. Considerable misunderstanding exists as to how joints of various types can be used to provide movement and what are the advantages and disadvantages of joints as compared with other types of flexible equipment.

There is discussion of the three methods providing flexibility in hydraulic systems:

1. Flexible hose—rubber, metal or synthetic.
2. Joints with pipe or tubing.
3. A combination of joints and hose.

• DESIGN FACTORS FOR HYDRO-PNEUMATIC SHOCK ABSORBERS

By John T. Ellis, Jr., Chief Engineer, Hanna Engineering Works, Chicago, Ill.

Because of the ever increasing speeds and loads

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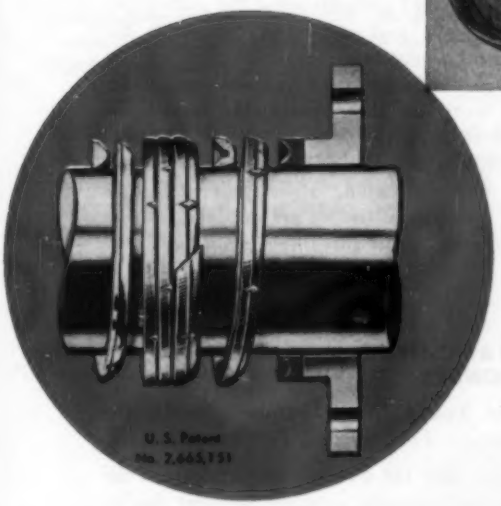
Linear VEE-DAM® rings



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KOHLER

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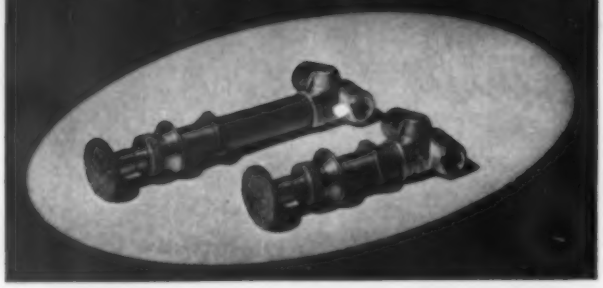

ENGINE PRIMERS for Industrial Applications

Kohler engine primers eliminate the usual causes of primer failure. They are used by leading Diesel engine manufacturers, builders of personal planes, by engine starting system fabricators and for other applications.

Ball checks open and close alternately with each stroke to insure a complete suction stroke and a complete discharge stroke. Two synthetic "O" rings produce a seal which maintains the suction and discharge strokes and also prevents handle leakage. This gives 100% displacement of fuel and assures a steady even flow to the combustion chamber. A ground seat and machined seating pin on the piston tip eliminate fuel seepage and flooding when primer is not in use.

These light-weight aluminum primers operate with gasoline, oil or ethyl ether. Call on us for your next engine primer requirement.

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AIR-COOLED ENGINES • PRECISION CONTROLS

encountered in modern industry, greater consideration must be given to alleviating impact shocks. Shock absorber applications are therefore becoming more commonplace. This paper first briefly discusses the history of this evolution and what it means in terms of industrial recognition.

The basic types of shock absorbers are discussed, as well as the requirements for ideal response in regard to velocity, acceleration, and pressures.

C. D. Young

J. T. Ellis, Jr.

Methods for alleviating initial impact shocks are considered. The paper presents what the author believes to be a new and simplified procedure for making orifice calculations.

Examples of the background and subsequent developmental work on three particular models of shock absorbers are given.

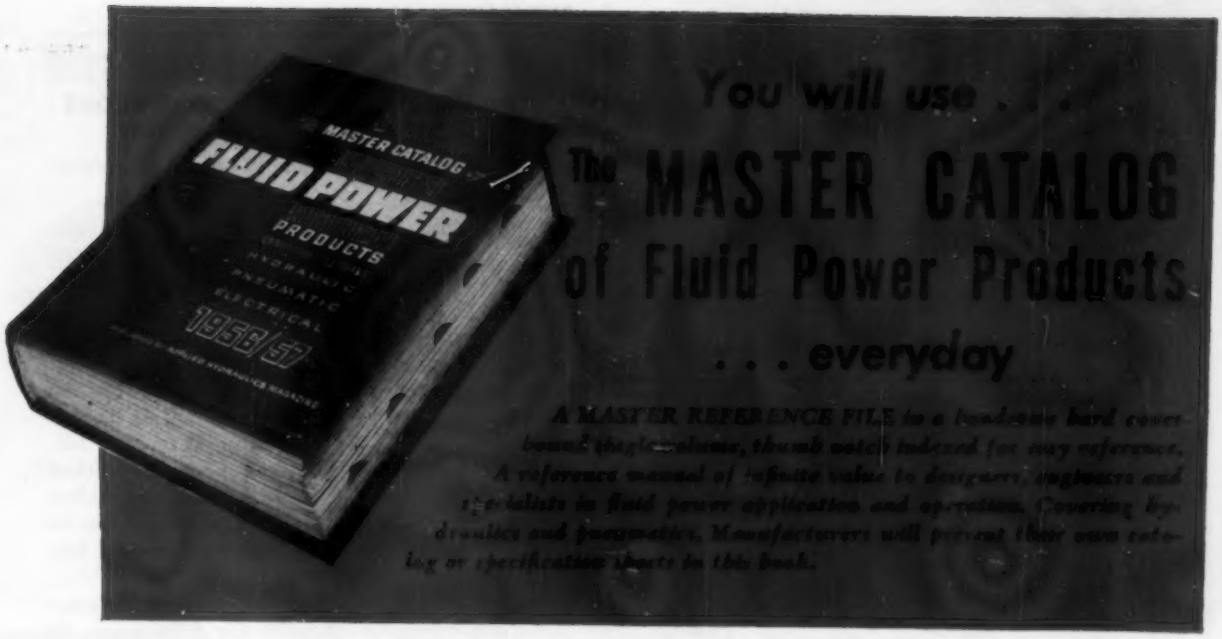
Various pitfalls encountered in shock absorber design are discussed, along with their solutions. Methods for operational testing are outlined, as well as instrumentation procedures for evaluation performance.

• PNEUMATIC-HYDRAULIC CYLINDER POSITIONERS

By Claude D. Young, Chief Engineer, Special Design Engineering, Foxboro Co., Foxboro, Mass.

It is factual that the Process Industries are demanding better automatic controls to meet the increasing complexities of their developments. Industrial Instrument Manufacturers must meet these requirements through increased speed of response, increased sensitivity and greater stability in their control and measuring devices. They must take advantage of all available tools that will enable them to improve the performance of their equipment to meet this challenge. Hydraulics, already playing a major role in modern industry, is a versatile, flexible and productive subject which offers great possibilities for further technical developments in this field. Engineering efforts must be directed toward the further use of this medium in the Process Industries and this paper suggests an approach to utilizing hydraulics to supplement an existing pneumatic control system.

Continued on page 120



Alphabetical Index of Products and Manufacturers. Every manufacturer will be listed under each product or service he makes or renders, with full addresses and cross references to Catalog page numbers.

Catalog Index Manufacturers Outlets. Catalog sheets with Special emphasis on specification and user data. A complete index to catalogs PLUS a list of all sales outlets—branch offices, field engineers, dealers and distributors. The first reference of this kind available to the Fluid Power field. The section will be thumb-notch indexed for quick reference.

Trade Names. This section will enable a buyer to locate a manufacturer and his specification sheets, if he knows the trade mark. Thumb-notch indexed for easy reference.

Engineering and Technical Data Section. This valuable section is edited with the practical requirements in mind of the designer, application and operating personnel in the major industries using fluid power circuits. A section on Basic Data will include specimen pneumatic, hydraulic and electrical diagrams; Fluid Power Circuits; pipe and tubing selection tables; charts of hydraulic fluid characteristics; graphic solution charts and fundamental formulae for selecting components and building circuits, etc.

There are separate sections covering major components of hydraulic and pneumatic circuits—pumps, valves, cylinders, packing and fluids, as well as control units and accessories.

A separate Table of Contents for the Engineering and Technical Data Section is designed to make this data of maximum usefulness. Thumb-notch indexed.

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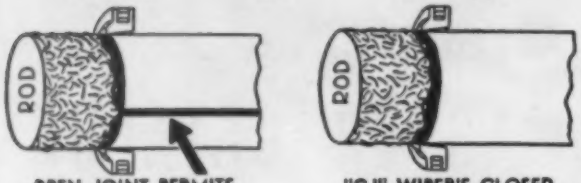

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For those dry operations requiring absolute freedom from dust or dirt passing through joint of ring to bearings or packings, we have especially designed—the

FALL WIPER RING with Closed Joint
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In addition to the above, and since 1944, we have also manufactured **For Army and Navy Use the 3 Piece FALL WIPER RING FWR-3C**
Spec. Mil-S-5049, AN Approved, Military part numbers from AN6231A1, ½", to AN6231A71, 13", diameter. This ring consists of 3 pieces assembled into one . . (1) a one-piece Split Wiper Ring (Body) with 3 flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in groove (3) an endless cover band surrounding spring in groove which causes squeeze grip action on piston rod.

Squeeze Grip Action Does It—patented

—and squeeze grip is always the same because uniform tension of spring under endless cover band. Rods or pistons do not stick or become immobile in ANY temperature.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

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Fall Wiper Ring SPRING LOADED

Covered by patents issued and patents pending.

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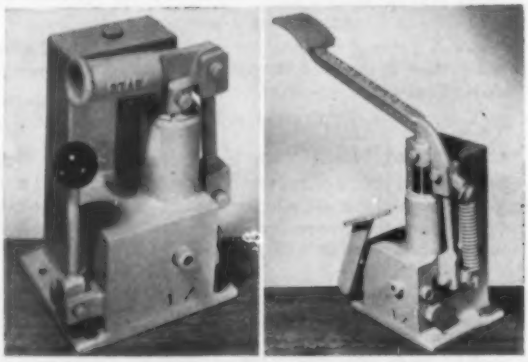

HAND OR FOOT OPERATED WITH SINGLE LEVER OR PEDAL

Two speed construction provides automatic change-over during operating cycle from high speed low pressure to low speed high pressure.

MAXIMUM CAPACITY 10,000 P.S.I.

Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger—5 models: (½"-⅞"), (½"-1¼"), (½"-1½"), (⅝"-1½"), (½"-2¼").

Special engineering counsel and proposals cheerfully submitted on request. Ask for Catalog #555.

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SUMMARIES OF NCIH PAPERS

• THE HYDRAULICS ON A CONTINUOUS MINING AND LOADING MACHINE

By J. J. Slomer, Hydraulic Engineer, Goodman Manufacturing Co.

Into the bowels of the earth this modern miracle machine bores into the face of coal producing up to six tons per minute in a continuous straight line advance.

At the coal face, twin rotating units, geared together, driven by an electric motor, and equipped with bit filled cutting arms, a center pilot bit and core burster, cut and break out the coal. As the machine bores ahead, a cutter chain, at top and bottom, cuts free the center wedges of coal not reached by the rotating arms. The cutter chain also widens the path at the bottom on each side, and can be arranged for cutting a wide flat top for cross barring.

All movements of the machine excepting the rotor arms are controlled hydraulically with finger tip control. The tank located between the tractor treads is a structural part and it is practically buried. Hydraulic motors drive the tractor drive through gear reduction units and are controlled independently for direction and for traveling on a straight line following sights in the roof. A multiple valve unit on the right hand side controls the elevating of the cutterbar, retraction of the lower bar, retracting the corner sprockets, the side tilting of cutting head, the forward and backward movement of the head, retarding the butters on the rotating arms, the raising and lowering and the swinging of the rear conveyor.

Hydraulic motors also drive the conveyor, the water spray if used, and the hoist, if used.

This particular machine has three pumps, one 20 gpm variable volume, one 20 gpm fixed volume and one 8 gpm for machine movements. The first two handle the low and high speed tramming, the constant volume pump also being used for driving the conveyor when the machine is cutting.

• HYDRA-TOUCH SYSTEM FOR FARM AND INDUSTRIAL TRACTORS

By Gordon L. Hershman, Chief Engineer, International Harvester Co., Chicago, Ill.

The Hydra-Touch system was developed to provide a versatile farm tractor hydraulic unit, accessible to mounted and trailing implements, and semi-automatic in operation to free the tractor operator's hands for other tasks. The basic system unit is the Hydra-Touch valve, a spool type valve, which through a hydraulically operated detent is returned to neutral (by-pass) when a hydraulic cylinder it is controlling completes the desired stroke.

The valve can operate both single acting and double acting cylinders, has a lock and float position for single acting cylinders, and locks both hy-

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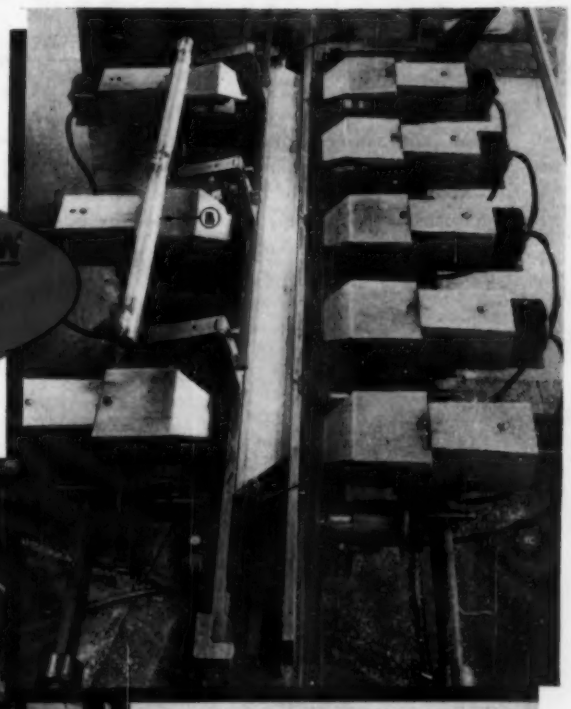
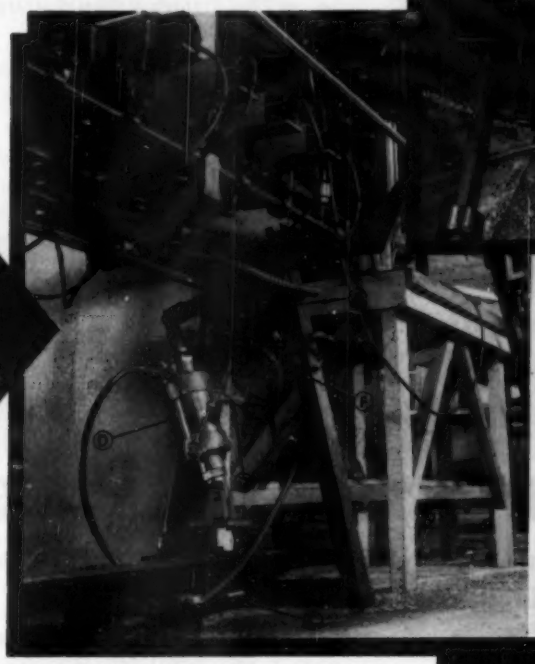
GET AUTOMATION'S SAVINGS NOW WITH *Modernair* FLUID POWER DEVICES!



Here's how *Rylock* did it:



Rylock air-actuated multiple drill automatically drills all holes on both edges of aluminum screen door frame piece in one operation. Independently-powered heads are movable, will accommodate all models of doors manufactured.

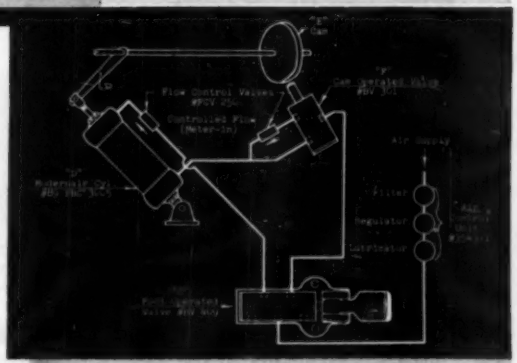
Operator places piece in fixture, depresses MODERNAIR foot valve C; MODERNAIR cylinder D advances and retracts all drills. Entire cycle requires 10 seconds.

Rylock Company, Ltd., California manufacturer of window screens and aluminum-frame screen doors, has a tooling problem typical of many plants turning out a wide variety of product sizes and shapes. Overall production is high, yet the "run" of any one size or type prohibits costly special tooling.

It's hardly a case for "automation" in the sense of tomorrow's pushbutton plant. Yet Rylock is enjoying the substantial savings of automatic production equipment *today* with air-powered equipment designed and built in their own plant.

A typical Rylock-Modernair application is shown here. We have many others on file that may give you some practical ideas on how to cut costs with MODERNAIR air or hydraulic cylinders and control valves. Why not write for your copy of the MODERNAIR Applications Manual *NOW?*

See our display — Booth #959, National Metal Exposition, Philadelphia Convention Halls, Oct. 17 thru 21.



Foot valve advances cylinder D rapidly until cam operates valve F which introduces flow control valve G into circuit. This slows advance during drilling cycle; on completion of cycle operator releases foot valve, cylinder D retracts drills.

Modernair CORPORATION

Member of National Fluid Power Association

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draulic lines of double acting cylinders.

One companion valve containing a regulator valve and safety valve is required for each system, however, the number of Hydra-Touch valves stacked together in one system is limited only by mounting space, pump and reservoir capacity. Normally three valves are banked together with one regulator-safety valve unit.

The system operates at approximately 35 p.s.i. by-pass pressure, and 1500 p.s.i. maximum safety

G. L. Hershman

Z. C. Van Schwartz

valve pressure. The valves will latch in detent at working pressures up to 900 p.s.i. and will release the hand lever to return to neutral at 1200 p.s.i. maximum pressure.

The Hydra-Touch valve is easily changed to single acting by moving an indexing bushing on the valve cover. In single acting, the valve will automatically return from the raising position to neutral, but in the lowering position it will remain in position to provide a float feature, or it can be returned manually to neutral, preventing the cylinder from lowering further, but will allow float upward. In operation where more than one valve is used, any valve or valves can operate single acting cylinders while the other valves in the same system are operating double acting cylinders, or all can be operating the same type cylinder. As it is a parallel hydraulic circuit, all operations can be carried on simultaneously.

• HYDRAULIC BURNISHING OF BEARING JOURNALS

By Zolly C. Van Schwartz, Director, Engineering Standards, Baldwin-Lima-Hamilton Corp., Hamilton, Div., Hamilton, Ohio

An analysis was made of a hydraulic power plant system to determine the best method of selecting control valves and power pistons that will give the optimum oil pressure distribution within the system. Two distinct problems had to be considered:

1. That which would provide a controlled hydraulic pressure system to a series of burnishing rolls, feed/traverse of the work carriages.
2. That which would provide a differential flow of oil to the power pistons of the driving mechanism

Continued on page 124

SHUTTER SLAT TENONER

Employs NOPAK Valves and Cylinders to Implement Automatic Operating Cycle

① Front view of Century Automatic Shutter Slat Tenoner with housing in place.

② Rear view with housing removed, shows 2 NOPAK Model E Cylinders and NOPAK Model V250-R Slide Valve.

This completely automatic machine, built by Century Tool and Engineering Co., Culver City, Cal., turns out 1200 tenoned wood shutter slats per hour, *automatically*. It cuts dowel-like projections on both ends of each slat and cuts the individual pieces to length. The machine continues to re-cycle automatically until the complete length of stock is cut into tenoned shutter slats.

The cutter head is moved into position by a 2" x 2" Model E NOPAK Cylinder. The stock is rotated 360°, during the cutting operation, by a NOPAK 2½"x6" cylinder, controlled by a NOPAK Model V250-R Slide Valve.

This is but one example of how NOPAK Valves and Cylinders are used in automated operating cycles in many types of machinery and equipment. For other examples, ask your NOPAK Representative to show you the NOPAK Application Manual.

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NOPAK
• VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

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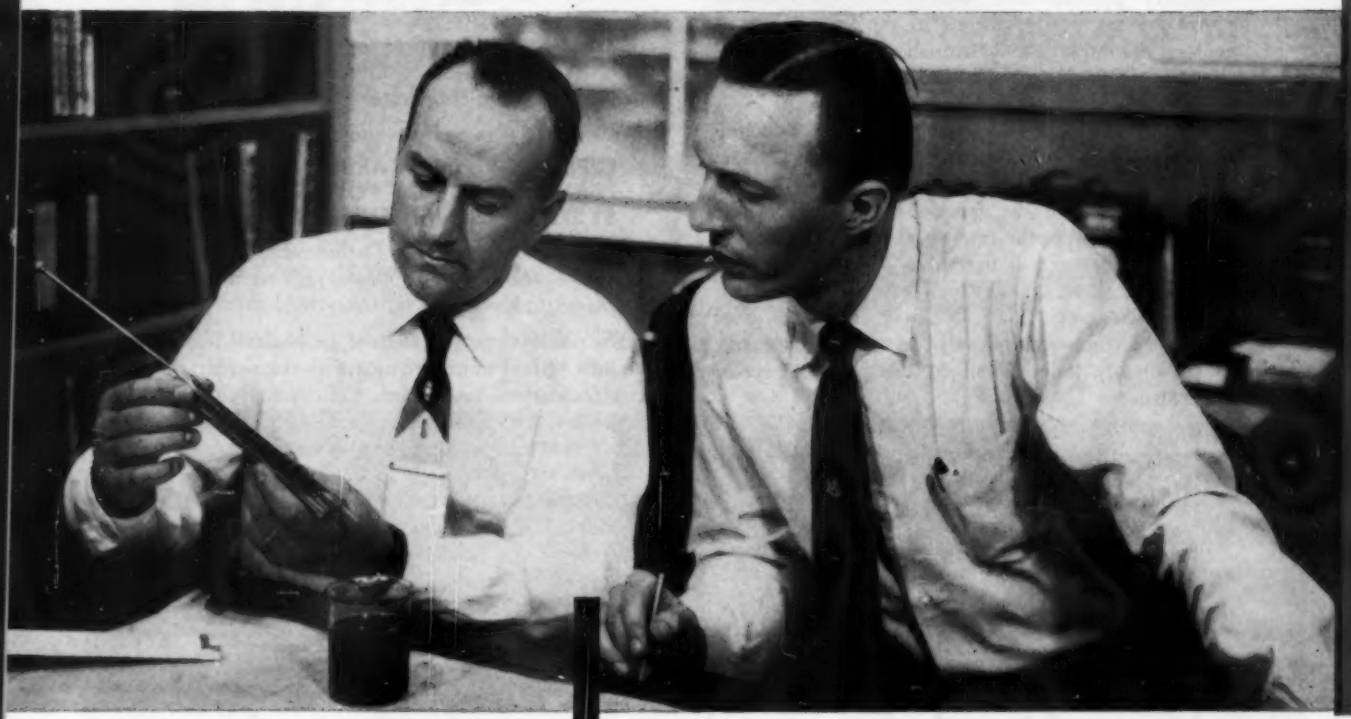
Seven years service for STANOIL Industrial Oil at David Bradley Mfg. Works —No down time for lubrication



L. R. Cummings (left), Standard lubrication specialist, inspects sample of STANOIL, with Robert C. Menken, Plant Engineer of David Bradley Manufacturing Works. Larry Cummings has been serving industrial customers for Standard Oil since graduation from Standard's Sales Engineering School. His mechanical engineering degree from Tri-State College of Indiana qualified him for this work. Customers of Larry's find this experience and background pay off for them.

David Bradley Tri-Trac, handy piece of farm equipment gives farmer new opportunity for mechanization at low cost. Upper frame on which gasoline tank is mounted, is part formed in HPM press.

Seven years ago David Bradley Mfg. Works installed 900 gallons of STANOIL Industrial Oil in an HPM press. There's been no down time required for lubrication maintenance since. A pump by-pass screen filter is the only filtering the oil receives, yet the system continues clean. In March, 1954, an analysis of the oil showed:

Viscosity @ 100° F.	— 980
Color, NPA	— 6
Neutralization No.	— .11

STANOIL Industrial Oil has long been at work for Bradley. Successful operations with it in other equipment caused Bradley engineers to specify STANOIL for this installation.

The HPM double acting, fast traverse hydraulic press reported on here is used to draw the upper frames for the David Bradley Tri-Trac, compact farm tractor. The Tri-Trac is the newest implement in the Bradley line. Bradley has been making farm implements since 1832.

Like to know more about STANOIL? Perhaps it can serve you as efficiently as it is serving David Bradley. Lubrication specialists in any Standard Oil office will be happy to help. In the midwest, a call to one of them will bring a prompt response. Or contact: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY
(Indiana)

at one end and a tail stock center on the other end.

Combination and duplex type pumps were mounted to the oil reservoir motor(s) for the necessary pressure and forces. The combination pump for the power pistons of the tail and head centers, the duplex pump furnishes fluid under pressure to the burnishing rolls and the carriages power pistons.

Feed and directional control valving of two distinct types were considered:

1. Those in which the oil flow is independent (or nearly so) of the reaction forces within the valve; in this type, the rate of oil flow is a function of the pressure across the valve.

2. Those in which oil flow is not independent of the reaction forces. The valve may use these forces to effect a compensation such that the oil flow rate is reasonably independent of the pressure across the valve.

● CONSIDERATIONS IN THE DESIGN OF HIGH TEMPERATURE AIRCRAFT HYDRAULIC PUMPS

By J. A. Mileti, Hamilton Division, Bendix Aviation Corporation, Hamilton, Ohio

Aircraft currently in the design stage will require hydraulic pumps to operate in the range of —100°F to somewhere between 400°F and 600°F within the next few years. The design of these pumps requires that careful attention be given to viscosity effects of fluids used, thermal changes in pump dimensions, decreased strength of materials and the annealing effect of high temperature on hardened bearing surfaces. Aircraft requirements are such that, in addition to reliability, high efficiency is required for optimum aircraft performance at these high temperatures.

● EFFECT OF FUEL CARRIED DIRT ON PERFORMANCE OF POWER CONTROL SYSTEM FOR JET ENGINES

By Mr. J. Barrett, Chief Turbine Engine Control Section, Power Plant Laboratory, Wright Air Development Center, Dayton, Ohio

The power control system of jet engines regulates the flow of fuel in accordance with the performance requirements of the engine. Contamination carried in the fuel may cause severe malfunctions and it is highly desirable to have the system as insensitive to contaminants as possible. Discussed are the important phases of a research program carried out to establish design rules and specifications to make control system components insensitive to dirt. These components include sleeve, poppet and needle valves, metering orifices, spring and fluid pressure operated actuating diaphragms. ▼▼▼

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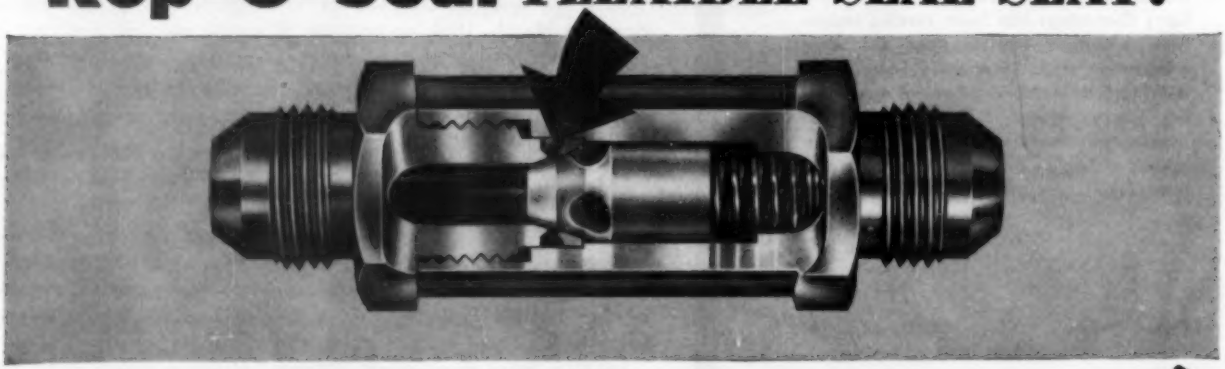

Absolutely bubble tight! An ingeniously protected O-ring (see photo) securely seals internal *and* external leakage. Extremely simple design without complicated, costly precision-fit parts. Dirt can't bother Kep-O-Seal Valves because the flexible seal closes around offending particles; no danger of permanent seat damage. No pressure at threads, no leakage nor weakness there. Long-lasting original O-ring (no friction, no wear) when finally replaced at small cost, completely renews service life. Stocked in 6 standard sizes of Dryseal pipe and JIC tube, in 12 connection combinations. Send for illustrated data sheet.

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CHECK VALVES
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Brand New HOUGHTON Development!

MOULDED "V" PACKING ADAPTERS

In one of the most *important* advances in Packing Design in years—Houghton's *Moulded* Adapters (Support Rings) for "V" Packings bring these new advantages:

1 BETTER SEALING
This moulded, yet resilient female ring *expands* under pressure, helping to form a perfect seal.

2 NO FATIGUE CRACKING
Houghton Adapters will withstand continuous flexing without fatigue cracking. Rings last longer, downtime is reduced.

3 SAVES PACKING
Because of tighter seal, packing cannot extrude around flange ends. This saves packing and reduces friction.

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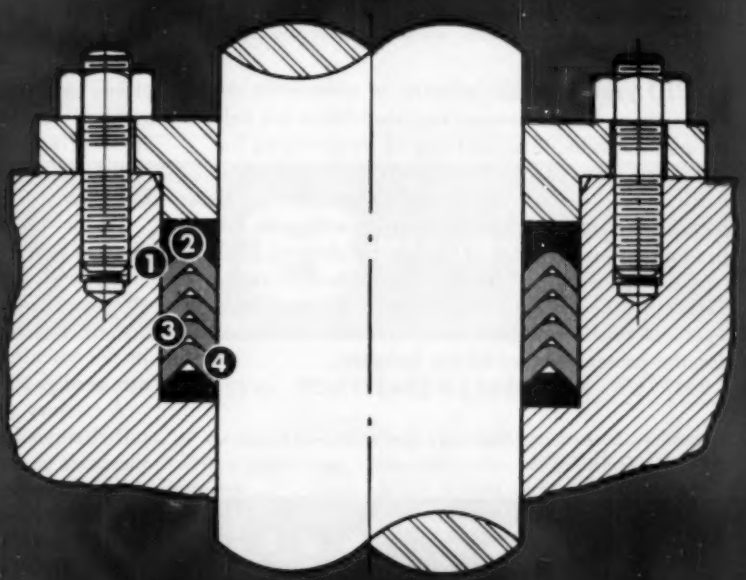
Houghton Adapters are tough and durable but will not abrade or score cylinder walls.



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What can be done by colleges to train men for the hydraulics industry? By modernizing some of the basic courses and by adding laboratory equipment, the University of Michigan is making it possible for the Engineering undergraduate to become more familiar with oil hydraulics.

Can Colleges Include Oil Hydraulics in Undergraduate Study?

• By Glenn V. Edmonson

RAPID growth of an industry is necessarily accompanied by increased responsibilities not only for quality, reliability, and cost of its products, but also for a rate of technological advance comparable with its expansion. The hydraulics industry can certainly point to a phenomenal growth rate. Expansion of application of hydraulic devices leads to the conclusion that its costs have likewise varied favorably. Technological advance and sound management can be assigned as the most likely reason for the present stature of the industry.

GLENN V. EDMONSON, *Professor, University of Michigan, Ann Arbor, Michigan.*

FIG. 1. HYDRAULIC TEST EQUIPMENT at the University of Michigan is used in undergraduate and graduate work.

Expansion of the oil hydraulics industry has resulted in an increasing requirement for technically trained personnel to carry on the advanced demands placed upon the research, design, and application groups. Many industry men who recruit young engineering graduates believe that the graduate lacks the required training for the oil hydraulics industry.

To answer this criticism, it is necessary for engineering schools to study the industry requirements and their technical problems to determine whether specially trained engineers for the industry are required or whether more vigorous efforts in the teaching of the fundamentals of engineering are needed.

A cursory study indicates that although many detail changes in component design have taken place, the basic principle of energy storage in a fluid and the conversion of that energy to mechanical power at a remote location, is unchanged. The demand for more power in less space, at lower weight, and longer life has always been at the fore-front of the industry. To meet these requirements, system pressure has increased progressively to accomplish higher energy storage per pound of fluid in the system. Changes of materials to withstand higher unit pressure, and development of better systems to take advantage of the increased pressures have continued. If these and other similar detail changes were the only advanced problems facing the industry it seems reasonable to believe that past engineering practice would have undoubtedly continued to be satisfactory.

However, a closer look reveals new problems calling for new approaches. There was a time when it was sufficient that the hydraulic transmission accom-

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plished a given motion. The rate-of-acceleration or the approximation to steady-state was of little concern. The words transient, frequency, and oscillation were academic.

Demand for shorter time cycles and all the inherent time-dependent phenomena accompanying high rates-of-response have made it necessary that the engineer have an exact knowledge of the transient and steady-state behavior of a system. Actually, the time-dimension could be assigned as the basic reason for many of the advanced problems confronting the engineer. Certainly, the steady-state viewpoint falls short in many cases. Is the present engineering graduate prepared to handle the advanced problems, and, if not, what can be done to prepare him? Any educational program is accompanied by a time limit, within which only a given amount of work can be accomplished.

It is well-known that an arbitrary but well-established time limit is in force for a majority of all those attending an engineering college. Within four years there are from 130-140 credit hours, or the equivalent, that can be included. This scheduled course work requires a minimum of 20-25 hours of active class participation per week, plus approximately twice that amount of time in preparation. Certainly, consideration of this time limit must enter any curriculum study and within this period the foundation of the profession must be taught thoroughly.

The tools of the engineering profession are the basic sciences: (1) Physics, (2) Chemistry, (3) Mathematics, (4) Thermodynamics, and (5) Fluid and Engineering Mechanics. It is doubtful that any one of these items should be excluded for any man's training, whether he is trained for the Hydraulics industry or other industries. At the present time the elementary subjects that fall in these groups require from 2½ to three years to complete. Without going into course detail it can be generally stated that the student is not prepared to handle many of the advanced problems that the industry encounters upon completion of the introductory course work.

A NEW CURRICULUM

Basic preparation for any engineer also requires that he acquire a command of the English language and a training in Human Relations. The engineers' present place in society, as well as his relation to any industrial organization, places a responsibility on those concerned with his education to encourage him to increase his breadth of interest and activity. This phase of education requires a portion of the limited time which is available.

Three important factors contribute to the training of the engineering student. These are (1) the formal course of study, (2) the interest of the student in his profession, and (3) the interest which industry takes in the student and the institution.

Certainly, it is the responsibility of the education institution, within the limit of its facilities and budget, to offer a course of study which will prepare the graduate engineer for his future work. Many of the studies that have been undertaken indicate that instead of a specialized training as in occasionally advocated, a more thorough training in the fundamentals of the engineering profession may be the best approach to a better training. Beginning with the Fall Semester 1955-56 a new Engineering Program leading to the Degree of Bachelor of Science in Engineering (Science) is being offered at

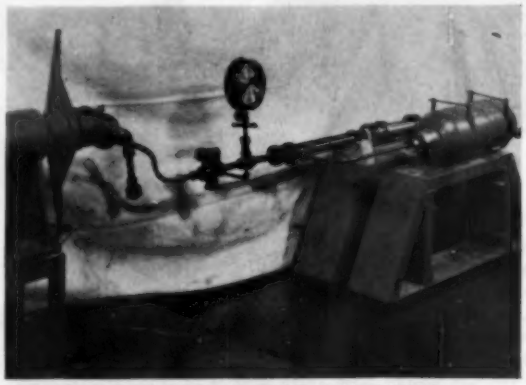

FIG. 2. QUICK DISCONNECT COUPLINGS connect each test set-up to the hydraulic panel shown in Figure 1. This research apparatus is used to determine characteristics of venturi with high velocity pulsating flow.

the University of Michigan. Reorganization of physics, mechanics, mathematics and chemistry is being made to give a closer relationship between subjects. This program of basic training is extended into the advanced topics of the subjects within the students' time limit at the University. This course sequence is not intended to be specialized, rather it is an advanced basic program. The Science Program is not intended to supersede the programs now being offered; however, it appears that the basic program of the first two years might well be adopted in any of the specialized areas of activity within the Engineering College.

The Mechanical and Industrial Engineering Department has been particularly concerned with the hydraulics industry. However, the efforts of the Department in both the undergraduate and graduate levels is directed toward providing the student with a basic understanding of problems rather than the detail of a particular system, particular component, or particular method.

For many years all the undergraduate students in the Department have taken a course, separated from Fluid Mechanics, which was concerned with the subject of Pumping Machinery. In recent years this course has been broadened to include basic performance theory of a wider variety of machine types, including not only those machines which add energy to the fluid, but also those elements of sys-

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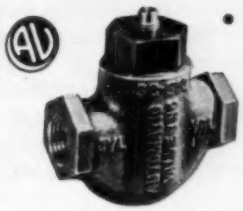

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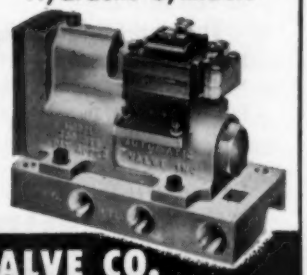

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tem which convert stored energy in the fluid to mechanical work. This course is designed to introduce the student to the field of hydraulic machinery, using thermodynamics as basis, and complement his undergraduate course work in fluid mechanics.

IMPROVED LABORATORIES

Laboratories are a necessary part of any educational program and must be correlated with the teaching effort. Accordingly, a consistent build-up of laboratory equipment at both the undergraduate and graduate levels has occurred. Among various items that are necessary, good basic instrumentation is a first requirement and must be arranged in such a manner that it is readily available. Figure 1 shows a portable hydraulic panel in the final stages of completion.

The panel is provided with gages to measure pressures from vacuum to 5000 psi.; it is provided with a timing circuit, shown to be assembled temporarily on a panel to the left in Figure 1, which will make possible simultaneous measurements of weight, flow-meter reading, and speed to an accuracy of .001 second. The circuit is equipped with a heater and heat exchanger controlled to provide constant viscosity, and a circulating and supercharging pump in order that any degree of backpressure can be maintained at outlet from the panel. Thermocouples located within the panel circuitry are provided at points where thermodynamic behavior of the fluid is important. Additional leads are provided in order that temperature measurements of units exterior to the panel may be made.

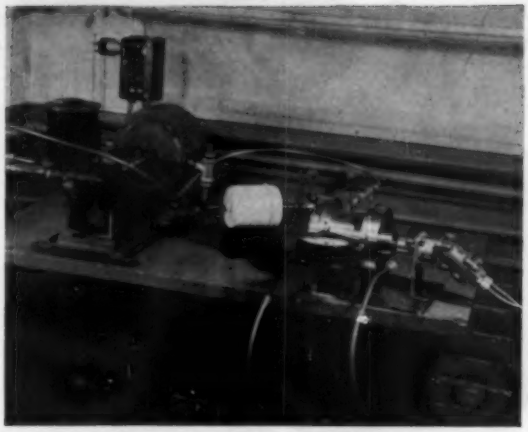

FIG. 3. FLOW CHARACTERISTICS between concentric contoured cylinders with rotating inner cylinder are determined on this set-up.

Rather than include the various hydraulic elements that would be the subject of a laboratory program within the portable panel, a group of laboratory set-ups are connected to the panel with quick-disconnecting fittings to give maximum use of the instrumentation, and at the same time make it possible to change set-ups rapidly. Figures 2 and 3

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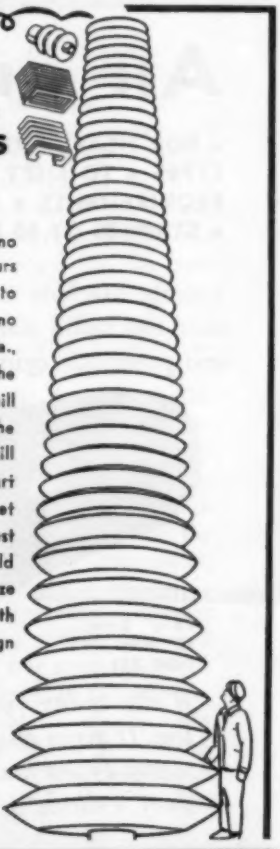

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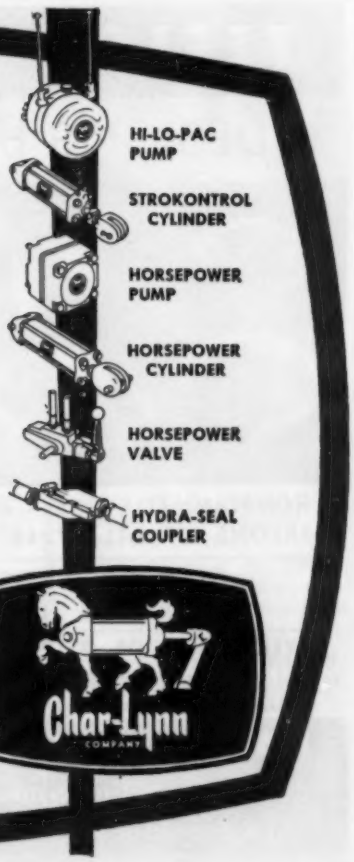

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are pictures of two of the set-ups. When advanced electronic instrumentation is required either for undergraduate instruction or Graduate research, actually two methods of assembling the amplifiers, oscilloscopes, batteries, oscillators, etc., are used. To the far left in Figure 1, a portable caged table is shown. At the conclusion of any laboratory period the instrument may be left intact and locked within the cage. A second method utilizes the eye-level desk space provided on the instrument panel. At the conclusion of the laboratory period, the instrumentation supported by the desk space is removed to storage. Flexibility is an absolute "must" in a college laboratory.

At the conclusion of the undergraduate program in Mechanical Engineering it is doubtful that the young engineer is prepared to hold his own in the details of circuitry, detailed equipment performance, and like matters with the veteran engineer in the field. He will, however, have a background and a method of attack which, when properly supplemented with training in detail, will soon put him into position to compete successfully.

While it appears that the best educational program will be the one in which increased attention is given in the basic sciences, it must be recognized that the engineer is concerned with the application of the scientific principles. An amount of specialization, in keeping with the limited time available in the undergraduate program, will without doubt continue in all curricula. Careful use of the limited time and a continuation of the specialized training in industry should provide exceptional technical personnel capable of handling advanced problems.

Because the training effort at both the undergraduate and graduate level is directed for the benefit of industry, industry has an important role. Time limitations prevent a student from availing himself of many areas of higher education. Necessarily, he is directed into those areas where "spoon-feeding" is most essential. It is expected that many areas of learning, equally important to the student and his employer, must be acquired by continued study. Industry may find it desirable to promote programs of study.

GRADUATE STUDY

When a student pursues graduate work in the field of hydraulics, he is assigned to a program advisor who recommends advanced courses of study, and generally assists the student in his advanced laboratory activity. The student takes on the definite responsibility of making effective use of his time and accordingly develops an added interest in his chosen profession through the counselling he received. The graduate program, the object of which is specialization, is directed to provide the student with advanced training in that field. In this instance, industry can also be of definite assistance and at the same time should benefit by

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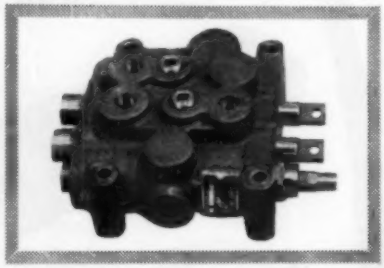

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its participation. Industry is in a position to know and define common, current technical problems that need directed effort to bring about a solution. These problems, when correctly defined, will be basic in character. Transmission of those problems to the graduate student will assist the student in his professional training. Material assistance often benefits all of the parties concerned.

TREND TOWARD FUNDAMENTALS

Within the last thirty years, industry has adopted the policy of using technical talent based upon the employee's ability to think, arrive at satisfactory solutions, and to get along and work with other people. Selections have often been made without regard for the undergraduate specialization the engineer may have pursued. Mechanical engineers are doing electrical engineering; civil engineers are practicing mechanical engineering, and so on. Therefore, various departments of specialization within engineering colleges are including more of the common course information so that the student will be better fitted to approach the task assigned him by his employer. The trend to basic engineering fundamentals logically follows.

It further follows that a close relationship and understanding between the school, the student, and industry is necessary. Each must assume that portion of the responsibility for training for which he is best suited. The result will be a well qualified engineer. ▼▼▼

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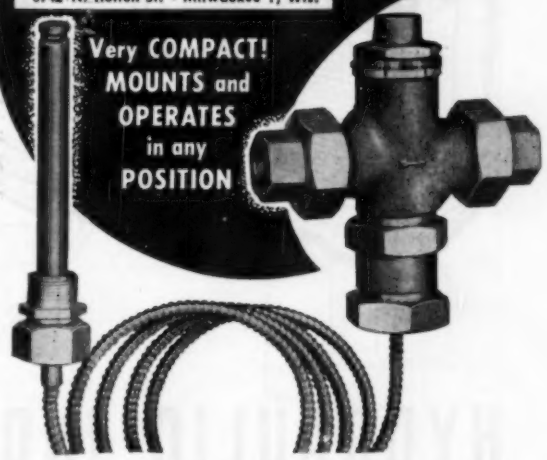

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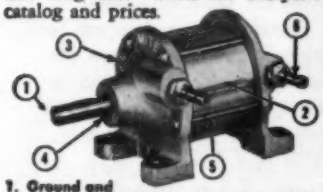

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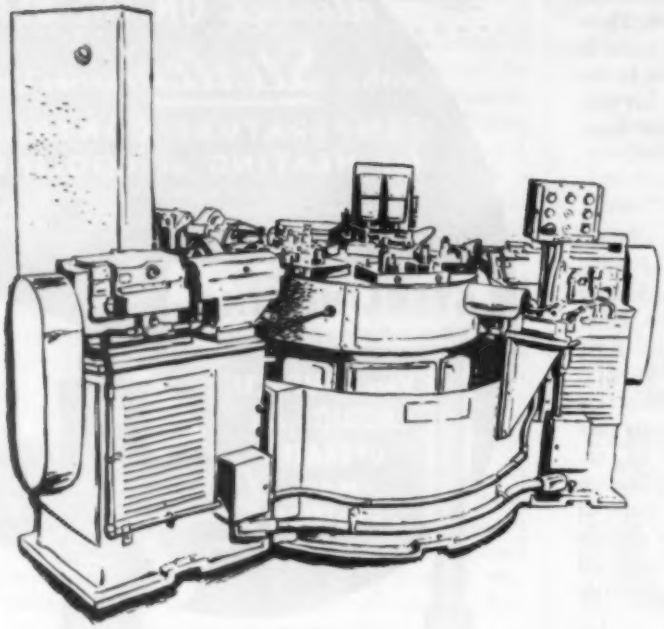

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HYDRAULIC INDEXING MECHANISM

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ROTARY indexing of the work is required for many machining operations. The designer has available a variety of methods for controlling and powering the index motion. Since space is almost always very limited, hydraulic power offers an important advantage—large output in a small package.

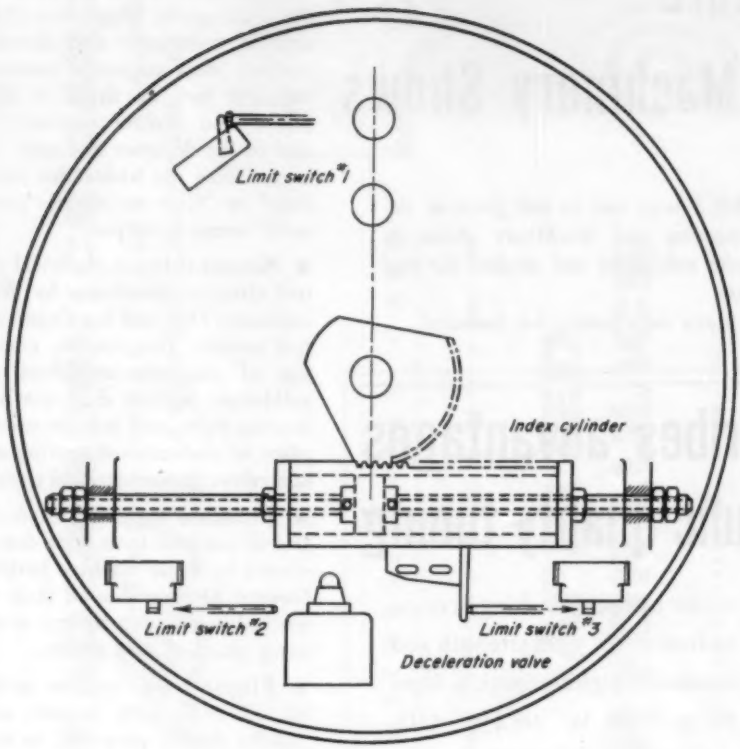
On a large index table, such as the 36 inch diameter unit built by Standard Modern Tool Co., Ltd., Windsor, about 2200 pounds of thrust are available from the hydraulic system. This is accomplished with a 3 inch bore double ended cylinder having a 1 inch rod and operating at a maximum pressure of 350 psi. The drawing illustrates the basic indexing mechanism. A clutch cylinder acts to operate the clutching mechanism which engages the table during the forward index and releases it to permit resetting of the index cylinder.

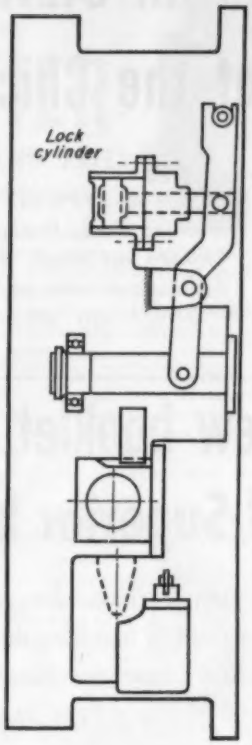
Operation is electrically controlled. A pushbutton energizes the unloading valve solenoid to close this valve and permit pressure buildup to the relief valve setting.

Before the index is initiated, solenoid C is energized to power the clutch cylinder which engages the table. 1LS is tripped to momentarily energize solenoid A. The index control valve is positioned to divert oil flow to power the cylinder in the index direction. Before the index stroke is completed, a cam slowly closes the deceleration valve to develop a back pressure which slows the table to a stop.

At the end of index travel 2LS is tripped to momentarily energize solenoid D and release the clutch cylinder. Solenoid B is also energized to cause reversal of the index cylinder. The table is not engaged for reversal. With this mechanism, movement of the table is in one direction only. At the end of the reverse stroke, 3LS is tripped to set up the next index stroke. The next stroke may occur immediately or a time delay controlled by a timing relay may be used.

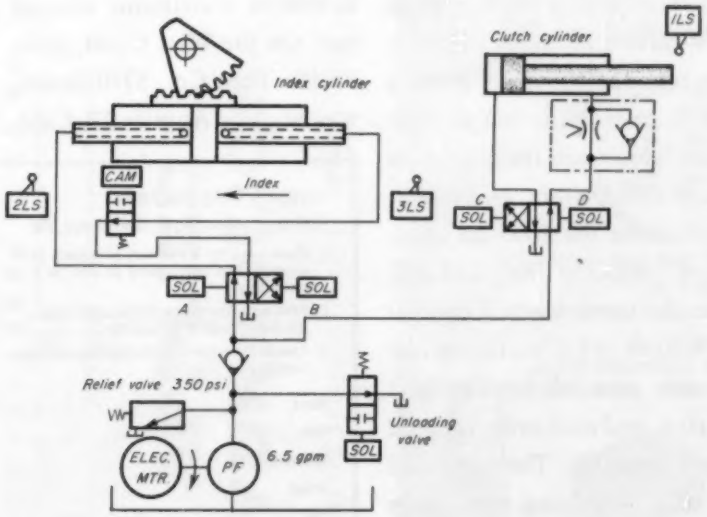
A table clamp cylinder which is not shown in the circuit drawing is used when table friction is not enough to hold the table during the machining operations. ▼▼▼





INDEXING is powered hydraulically through the gear segment and rack mechanism. Timing and stroke reversal is controlled by limit switch actuation. The deceleration valve acts to cushion the forward index stroke during which the inertia of the table and fixtures must be controlled to prevent shock at the end of the stroke. On the reverse stroke, there is no table load on the cylinder so that deceleration control is not necessary. In this design the piston rod is rigidly held causing movement to be transmitted to the cylinder body which is integral with the gear rack. Lock cylinder operates to engage or disengage the table.

SOLENOID VALVES in this circuit are panel mounted for accessibility and convenience in piping. With all solenoids deenergized, the pump volume circulates back to tank at zero pressure through the unloading valve.



An AH Staff Picture of the Chicago Machinery Shows

Editors of APPLIED HYDRAULICS were out in full force at the Machine Tool, Production Engineering and Machinery shows in Chicago last month. We talked with exhibitors and studied air and hydraulic systems and components.

Here, briefly, are some of the many impressions we gathered.

• **Perhaps** the most important impression we got at the show was the marriage or integration of hydraulic, pneumatic and electrical control. Most automatic machines included two or three of these power and control sources. The day of the designer and user who says, "Give me hydraulics everytime" or "Give me electric power only" seems to be past.

• **Newest thing** in electrical control circuits was shown by Westinghouse. They call it a Cypak control system. This system, consisting of magnetic amplifiers and solid-state devices, does not have moving parts, and may be used in place of conventional moving contact relays in machine tool circuits.

• **Punched tape** and card control of machine tools were demonstrated by many machine builders. General Electric showed their numerical positioning control system using punched card system.

• **Plastic hose**—we saw quite a bit of it being used. In many cases just for display purposes; in some cases in the actual machine circuit. Ex-Cell-O was using plastic hose for air and oil lines on machine fixtures.

• **Revamping** of foot operated production machines to air operation was emphasized by National Pneumatic. They converted a foot operated shear, kickpress and a small inclinable punch press. Looks as though there would be a good market for a conversion kit which would permit the user to make an easy changeover to pneumatic power.

• **Are there** many hydraulically driven machine tool spindles? Most of the hydraulic spindle drives we saw were on tapping machines. National Automatic Tool Co. showed a 5 way, horizontal, vertical, angular driller tapper. Feeds were all hydraulic and the taps were driven hydraulically. They get 8,400 reversals per hour with a fluid motor. This is tough service—too tough for electric motors. Motor reversal requirements are the reason for a fluid motor drive on tappers. Hanson-Whitney showed a thread miller with a hydraulic spindle drive. Fluid power was chosen here because an elec-

Continued on page 138

New booklet describes advantages of Superior hydraulic quality tubing

Tubing is the modern, efficient method of handling fluids. Because it saves space and weight and is easily bent and flared, the number of fittings required is reduced and so are installation costs. In addition, it offers tighter joints, greater strength, and less pressure drop.

Seamless hydraulic tubing has been a SUPERIOR speciality for many years. From the melting of the steel to the final flare testing of the finished tube, the production of SUPERIOR low-carbon tubing is a quality operation. Tubing is given a 100% hydrostatic test at pressures which raise the fiber stress to 15,000 psi—in many sizes well above the 1000 psi minimum required by SAE-JIC specifications. Carbon content is held to .12% maximum for greater ease of bending and flaring, and each order is tested for flareability. The steel used is of a non-aging type made under a special melting process to insure low yield strength and unusually high elongation. Sizes range from 1/8" to 1 1/8" OD.

Complete information concerning SUPERIOR HYDRAULIC tubing, including maximum working pressures, bursting pressures, velocity and flow charts, etc., is contained in a new booklet, shortly to be published. Use the coupon to obtain your free copy, testing samples—and the name of the SUPERIOR distributor nearest you. On the West Coast, write Pacific Tube Co., 5710 Smithway St., Los Angeles 22, Calif.

SUPERIOR TUBE COMPANY
2030 Germantown Ave., Norristown, Pa.

☐ Please send me a free copy of Bulletin 39 on Superior Hydraulic Tubing as soon as it is released.

☐ Send me a free sample of hydraulic tubing " OD and " wall to be used for_____.

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6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

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10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
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15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
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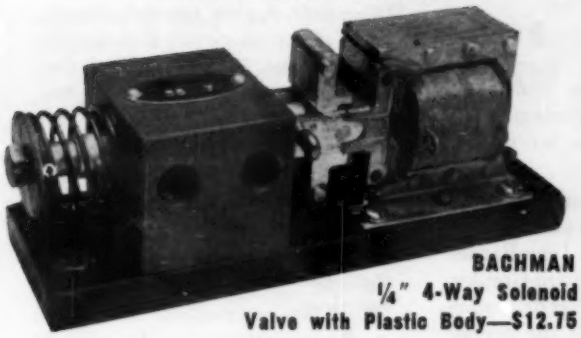

BACHMAN
¼" 4-Way Solenoid
Valve with Plastic Body—$12.75

If you are looking for low cost dependability here is a constant duty direct solenoid valve for 200 psi with ⅛" orifice—at a price below most hand operated valves. The body is machined from tough canvas base phenolic with ports perpendicular to the laminations.

These valves give millions of cycles of quiet and trouble-free service because the resilient construction *quietly* absorbs the kind of punishment that damages harder materials.

Stems are hardcoated aluminum and permanently resist wear or abrasion. Seals are standard O-rings.

With these units you can operate, check or cushion air cylinders. In air-hydraulic systems they will provide positive check or dwell. Use them for many combinations of manual or automatic control. The valve illustrated is 7" long, weighs 2 lbs. and mounts in any position. Other models have double solenoid and also hand, foot or mechanical actuation. All have ½" stroke with spring return optional.

Let us mail you complete literature or ask us to send you one of these units for a 30 day test and decide for yourself whether this long life leakproof valve can save you money.

JOHN D. BACHMAN & CO.
1713 Sparger Lane — Bristol, Tennessee

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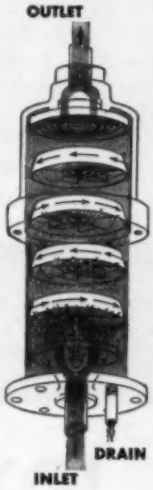
EQUIPMENT LASTS LONGER
...PERFORMS BETTER...
when the

ARIDIFIER

SCRUBS, CLEANS AND DRIES
On Air and Gas Lines



LASTS LONGER because...
The Aridifier's patented centrifugal-baffle action traps 92% of all dirt, oil, scale and water in gas or compressed air . . . and drains off these troublemakers *before* they can damage tools and equipment.

PERFORMS BETTER because...
The Aridifier protects tools against the freezing, fouling, caking and corrosion caused by dirt and foreign matter . . . assures the clean, dry air and gas that means better spray work, painting, lacquering, sand blasting, air cleaning, and similar operations.

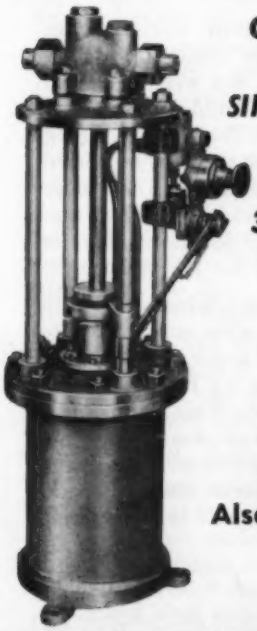
Easily installed, the Aridifier maintains itself. 10 models. Capacity range; 7 CFM to 17,000 CFM.

Learn HOW the Aridifier scrubs with a patented centrifugal-baffle action.
Write for This Catalog Now!

Logan ENGINEERING CO.
4920 W. Lawrence Ave., Chicago 30, Ill.

AIR-HYDRO-PUMP

60,000 PSI HYDRAULIC PRESSURE (with air—100 psi)



COMPLETE RANGE OF 35 STANDARD MODELS, SINGLE OR DOUBLE ACTING FROM 230 PSI WITH OUTPUT FROM 3,360 CU. INS. PER MIN.

- Air-Hydro-Pump is the finest pressure unit for rapid testing of valves, boilers, piping pressure vessels.
- Sustains constant pressure on Rolls, Rams, Presses.
- Portable for site testing.
- Water, Oil, Diluted Alkalis or Acids can be used.
- Made of non-ferrous metals.

Also 6 JUNIOR MODELS

Fluid pressures 400 psi to 10,000 psi $185.00 f.o.b. New York

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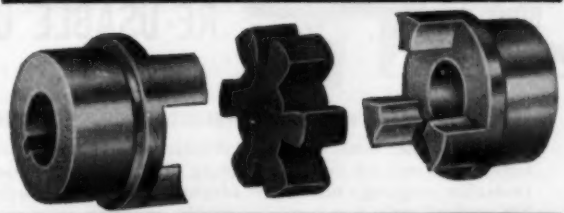

FLEXIBLE COUPLING with Concave Jaw Surfaces...

The exclusive CONCAVE jaw surfaces of the Gerbing Flexible coupling actually holds the Buna-N rubber insert or spider within the jaws and prevents the rubber from extruding under load. Effectively absorbs shock, vibration, and misalignment. Requires no lubrication. Available for shafts ½" to 2⅛" and H.P. ranges from fractional thru 30. Deliveries from dealer and factory stocks. Increase your coupling service life. Write for complete information.

Concave jaws hold spider in position at all times... no extruding

Hub, bore, and outside diameter concentricity assure vibration-free operation.

GERBING MANUFACTURING CORP.
Northbrook, Ill. (Suburb of Chicago)
Dept. AP 1055

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tric motor to do the same job was found to be too big. Also with the fluid drive, adjustment for variable speed is easy. When it comes to comparing efficiency, hydraulic motors don't fare too well. That's why most machine tool spindles are electric driven.

• **New hydraulic** equipment seen at the Machine Tool Show included a line of 5000 psi pumps built by Vickers. They also showed a hydrostatic servo controlled transmission which presents new design possibilities for mobile equipment.

• **The most** unusual technique for reducing maintenance costs was shown by W. F. & John Barnes Co. They call it an Electro-Graphic Detector System. The system adds less than 2 percent to the overall cost of a machine and looks like it should save its original cost many times over. A glass covered, illuminated electrical circuit drawing of the machine is mounted on the control panel door. Connections are made from the controls in the panel to the back of the drawing. With a test probe, the maintenance man can check out each circuit by inserting the probe into appropriate test points on the circuit drawing. Indicator lights signal the functions.

• **Pneumatics** was the power source on many loading mechanisms. Seneca Falls Machine had a mechanically actuated loader using air for clamping and positioning. This particular model has a capacity of 35 pounds.

• **Big changes** in machine design since the last Machine Tool Show in 1947 have been brought about by JIC standards for hydraulics, pneumatics and electrical controls. Most machine tool builders seem to be following the standards. Many are going beyond the standards and using them only as minimum requirements for their designs. However, some builders still hide power units in the machine base or column.

• **Of course,** the big trend is toward automatic handling—elimination of manual machine loading and unloading—hydraulics and pneumatics is the power source for most feed and transfer devices seen at the shows.

• **"Automation** with standard machines" the slogan for Bakers Brothers Inc. is a widely accepted idea by most builders of transfer lines. Snyder Tool & Engineering displayed what they call segmented transfer machinery. The whole idea is to make these giant machines flexible so that changes in a production line are possible.

• **Moving machine** slides with a hydraulic servo steering device is the aim of a new unit shown by Westinghouse Air Brake. The unit is the same one designed for steering mobile equipment. No cylinders are used. The servo valve and fluid motor are enclosed in a package which mounts in the steering column.

• **Models** of a Barber-Colman gear hobber use both hydraulics and pneumatics to power the loading device. The pneumatic loader,

PERMITS THE USE OF MORE ABRASION-RESISTANT, RUBBER-COVERED HOSE

Insure longer wear in your hydraulic hose assemblies—and at the same time, save assembly time by avoiding old-fashioned skiving. Joy Surgepruf re-usable couplings make *both* advantages possible. Their exclusive "double-wedge" grip lets you use tough, abrasion-resistant, rubber-covered hose instead of the braided type—without any need for skiving the hose at the connection.

NO SPECIAL ASSEMBLY TOOLS REQUIRED

You need no mandrels or other special tools to make up Surgepruf assemblies. No extra expense or special technique is involved.

CAN BE RETIGHTENED WHEN LOOSE ON THE HOSE

Machine vibration or hose flexing can loosen any hydraulic coupling on the hose in time, but Surgepruf Couplings can be easily, quickly retightened on the job to stop a leak—*another* exclusive feature.

Surgepruf Hose Couplings are made to JIC Standards. Assemblies are available in many sizes and lengths, and in both single and double-wire reinforced types for medium-high and high pressure service respectively.

Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.

Get complete data on Surgepruf:
WRITE FOR BULLETIN H-100c
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JOY
HYDRAULIC ASSEMBLIES THAT GIVE YOU MAXIMUM RELIABILITY

W&O H5518

we were watching, operated about every 30 seconds. Every so often there was a jerky motion caused by compression of the air. While it didn't affect the operation of this loader, it certainly illustrated why designers of mechanisms handling heavier parts prefer oil power.

• **All** of Rockford Machine Tool's machines use hydraulics. On lines over 2 inches, O-ring flange fittings and welded connections are used. With the trend toward higher speeds and greater horsepower, there's a need for larger components to handle increased oil flow.

• **Users of drill presses** are being offered a wider selection than ever before of power feeds. Mead Specialties showed a new air powered-oil controlled package feed which can be attached to most standard presses. So did Walker-Turner.

• **Reducing manual effort,** stepping up production and obtaining more uniform quality are the big reasons for the large crop of fluid power feeds seen on many machines. A. P. deSanno & Sons, who exhibited cut-off saws, had one model with a hydraulic feed. It adds about $1,000 to the cost of the hand operated job.

• **Pressures to 5000 psi** are talked about by press builders K.R. Wilson. Their exhibit included a press operating at 2500 psi. They say they are looking for reliable components for 5000 psi. If reliability could be assured, the 5000 psi circuit offers many advantages to the press builders.

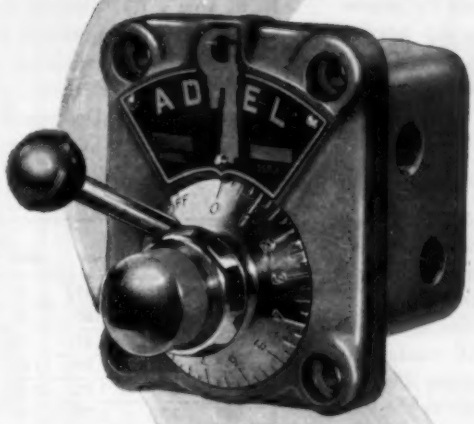
• **Greater unit output** by standard as well as special machines was impressive. One example of a new design for greater speeds was a full hydraulic 3 dimensional radial contour turner built by Monarch Machine Tool. They had a pilot model using a "coke" bottle as a template. The feed rate using this full hydraulic unit is 120 ipm as compared to 60 ipm obtained from Monarch's air-hydraulic tracer.

• **Among the many** automatic loading devices exhibited, Monarch had one of the most outstanding oil powered mechanisms loading and unloading a single spindle lathe. This model could handle a part weighing up to 90 pounds.

▼▼▼

THE NEW ADEL

FLOW CONTROL VALVE FOR VERSATILITY



Adjustable from completely shut off position to 25 G.P.M. maximum flow. Will maintain constant fluid flow and constant machine feed over a wide range of pressures and feed resistances.
The diagrams show but two of innumerable circuits and systems where this versatile and better valve can be used to advantage.

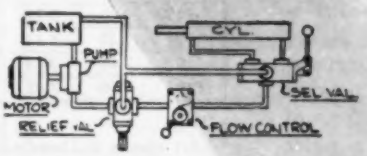


Diagram illustrates typical circuit showing control of cylinder.

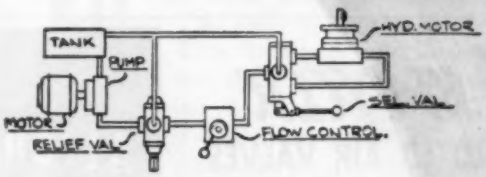


Diagram illustrates typical circuit showing control of hydraulic motor.
8 model variations are available—¾ in. Pipe Size—1, 2, 4 & 6 G.P.M. Flow Max.
¾ in. Pipe Size—10, 15, 20 & 25 G.P.M. Flow Max.

CHARACTERISTICS

1. Valve is compensated type which maintains substantially a constant flow regardless of variation in inlet and outlet pressure.
2. Maximum recommended inlet pressure 1500 P.S.I.
3. Maximum recommended outlet pressure equals inlet pressure minus 100 P.S.I.
4. No drain line required.
5. Wide range of control lever rotation (270°) permits extremely accurate flow settings.

For complete engineering specifications and counsel, Address: ADEL DIVISION—GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California.

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PRECISION PRODUCTS
A DIVISION OF GENERAL METALS CORPORATION

Manufacturers of Industrial Hydraulic Control Equipment

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TRI-STATE SUPPLY COMPANY, BROOKLYN 33, N. Y.

AFTERCOOLERS

. . . to protect air circuits

MOIST, compressed air shortens the life of air tools by removing lubrication, clogging nozzles, eroding air passages, and scoring and pitting air cylinders. Work spoilage because of moisture in compressed air systems is quite common. Morning blow-offs are sometimes required to clear the line of moisture. Low compressor output may result as well as broken air lines from frozen condensate.

The more compressed air is cooled prior to use, the less water and oil vapor it will contain to condense in the system. Because condensation decreases as the temperature decreases, a point is reached beyond which it is not economical to reduce the temperature. Common practice is to bring the air within 10 to 15 degrees of water temperature using a water flow of about 1 gallon per 100 cu. ft. of free air. However, 2-degree coolers are recommended for certain installations such as control instruments and automatic production equipment. Decreased maintenance provided by 2-degree coolers is especially important where assembly lines and automatic machines are dependent on compressed air. A breakdown on such equipment can be extremely expensive.

To illustrate the function of one model of after-cooler which cools the air to within 10 degrees of the cooling water, consider the following example. A 100 psi system delivers 100 cfm for an 8 hour day. The temperature at the compressor outlet is 275 F. Without an aftercooler, the system temperature is 110 F because of radiation of heat

Temp. of Air	POUNDS PRESSURE COMPRESSED AIR											
	30#	40#	50#	60#	70#	80#	90#	100#	110#	120#	130#	150#
32°	.575	.432	.36	.28	.25	.23	.21	.18	.17	.14	.13	.12
40°	.75	.60	.50	.43	.38	.33	.30	.29	.26	.24	.23	.21
50°	1.15	.89	.76	.65	.55	.48	.43	.40	.37	.34	.32	.29
60°	1.58	1.29	1.07	.93	.82	.71	.63	.55	.47	.45	.43	.40
70°	2.17	1.73	1.50	1.30	1.15	1.03	.94	.86	.77	.72	.69	.57
80°	2.90	2.39	2.00	1.78	1.58	1.43	1.27	1.15	1.03	.98	.92	.81
90°	4.03	3.28	2.76	2.42	2.16	1.96	1.73	1.58	1.44	1.35	1.26	1.10
100°	5.33	4.43	3.74	3.22	2.88	2.58	2.30	2.16	2.00	1.84	1.73	1.56
110°	7.00	5.75	4.90	4.25	3.75	3.34	3.02	2.76	2.60	2.36	2.18	1.95
120°	9.50	7.45	6.55	5.57	4.87	4.37	4.02	3.68	3.34	3.16	2.94	2.59

Courtesy R. P. Adams Co.

Chart shows gallons of moisture carried by 100 cfm of air in eight hours.

BECKETT Hi-CYCLIC

SOLENOID VALVE-PILOTED AIR VALVES

☆ Full Pressure Piloted

¼" SIZE

MODEL BVP1—Single Solenoid less exhaust controls.

$34.10

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Look to Beckett for advanced design! A complete line—150 models—of air and hydraulic directional control valves . . . *precision-built, economically priced!* Send for catalog.

BECKETT-HARCUM CO., INC.

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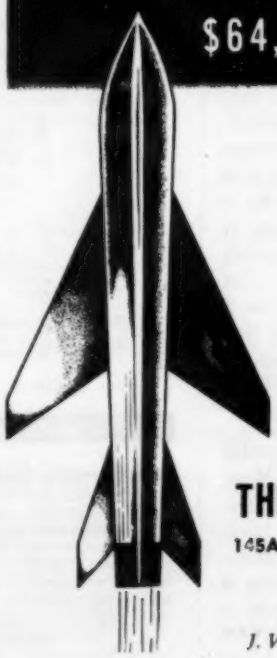
Circle 20 on Reader Service Card

Attention Engineers!

Do You Have A $64,000 Question?



With today's new developments engineers are looking for a seal which is effective at temperatures over 1000° F and pressures exceeding 25,000 psi. Let Darcoid solve the problem with THE WILLS PRESSURE FILLED "O" RING.

Write or phone for design and installation data.

THE DARCOID CO., Inc.

145A Sixth Ave. • New York, N. Y.

• ALgonquin 5-1393 •

Authorized representatives for J. V. Tripoli & Co., Inc., Buffalo, N. Y.

Circle 39 on Reader Service Card

from the lines. In the table, reading over on the 110 F line we find that 100 cfm of air for an 8 hour day at 100 psi contains a total of 2.76 gallons of water flowing to the tools every day.

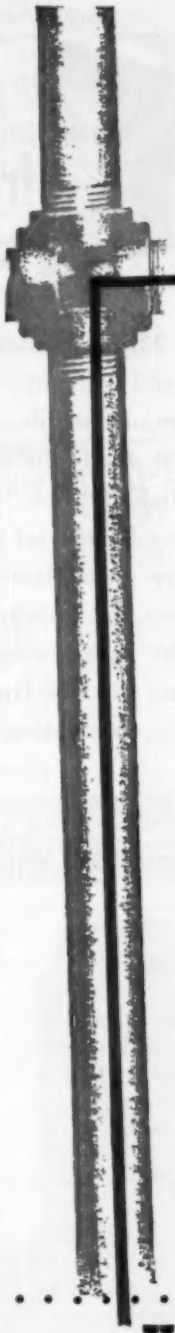
Usually plant water is about 50 F. With a 10 degree aftercooler we can cool the air to 60 F. Reading over on the 60 F line we find that the same amount of 100 psi air at this temperature would contain .55 gallon of water. By cooling the air, 2.21 gallons of destructive water have been condensed out.

To find the quantity of water in any fraction or multiple of 100 cfm for an 8 hour day, the values in the chart are multiplied by the appropriate factors. For instance to compute the water content of air from a 30 cfm compressor operating an average of 4 hours per day, we multiply the figure obtained from the chart by .3 and .5. The chart is based on saturated air, since we are concerned with condensation which occurs only at saturation.

Water and air are the most commonly used heat transfer agents for industrial air systems. The after-cooler is usually designed to remove about 90% of the moisture and oil in the air. Aircraft pneumatic systems use a mechanical moisture separator and a chemical drier to remove moisture. The separator removes about 90% of the moisture and the drier removes the remaining 10%.

The air-to-water aftercooler consists of a steel shell containing water tubes. Air is cooled as it circulates over these tubes. The water is usually piped for a counter-flow to obtain a maximum temperature differential. Associated with the aftercooler is a separator which separates and collects the condensed moisture. One model is designed, so that the air flow forces the moisture against the sides of the separator where it flows into a collector. This collector can be fitted with an automatic trap to eliminate manual draining.

Water-type aftercoolers should be installed indoors to prevent freezing of cooling water. They should be connected as close as possible to the compressor. Line aftercoolers may be installed in the distribution lines as required. ▼▼▼



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safety hydraulic fluids

UCON Hydrolubes are a *combination* of ingredients blended in balanced proportions for maximum safety, maximum efficiency, and easy maintenance—a synthetic lubricant, water, effective liquid and vapor phase corrosion inhibitors, special anti-wear agents, and an anti-freeze.

All these components add their beneficial properties to give UCON Hydrolubes remarkable advantages: fire-resistance that has been proved both in the laboratory and in 7 years' industrial use . . . no harmful effects on packings and seals . . . high viscosity indexes (150 to 160) . . . low pour points (below minus 55°F.) . . . no toxicity problems.

UCON Hydrolubes are supplied in viscosities of 200, 300, and 550 S.U.S. at 100°F.—and others can be made. There's a UCON Hydrolube to do *your* job.

Remember: **SAFETY** *is no accident . . . return the coupon today.*

UCON Trade-Mark Hydrolubes *are products of . . .*

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A Division of Union Carbide and Carbon Corporation
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Standard and special formulas developed for specific or unusual conditions. Assure the best combination of physical properties, strength in tension and compression, hardness and ability to sustain both static and dynamic loading.

Protect moving parts from injury, scoring, and seizing due to temporary interruption or failure of lubrication. Will not powder under the most severe conditions of service. Available rough cast or machined to precisely controlled tolerances. Can be machined at surface speeds up to 875 lineal feet per minute. Castings to your patterns, any size, shape or section, delivered as scheduled and specified. Pattern making, designing and machining when required.

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American Crucible
PRODUCTS CO.

"Bearing Specialists Since 1919"

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Ideas from a Sales Engineer

Elmer F. Heiser

During Elmer Heiser's 18 years of selling air and hydraulic components, he has solved many problems and has left some unsolved. He is the author of the recently published book "*Air and Oil Cylinders in Industrial Applications*". Because we enjoy learning of Elmer's experiences and opinions, we've asked him to write these monthly columns. We hope you too are finding these columns amusing, interesting and informative.

"Design It So We Can Maintain It"

PERHAPS the easiest air or hydraulic installation to engineer is the one that's too big to assemble in the home plant, and is shipped too far away for the designer to get involved as the bugs are worked out. It is simplified because the designer can live under the illusion that what looks good on paper is also good in the field.

However, we learn the most about equipment when trouble arises and it doesn't perform exactly as expected. Those jobs which work out as anticipated, teach little except perhaps that our judgement was good. That can be bad.

The toughest job to get mixed up with is the one which will be assembled and tested right at home where the engineer must not only work out the original design but be on hand to get it rolling and keep it rolling. When the guy who lays out the system knows that he will be responsible for not only the initial operation but also for continued operation, his engineering may follow a different pattern. He must recognize some problems which otherwise might not be apparent to him. He cannot design problems into the equipment for somebody else to worry about.

He won't be inclined, for esthetic reasons, to bury valves, cylinders, pumps or piping, sacrificing accessibility for appearance. Nor will he arrange the equipment and piping so that it will be necessary to start dismantling from one end, breaking connections etc. to get to a valve or fitting at the other end. On some critical installations he may even arrange the system so that air can be bled from the high points. It would be obvious that a mere note on the diagram, advising whoever is stuck with assembly and maintenance to "Bleed the air from the system" is not enough. That's him now.

One installation is recalled in which part of the hydraulic equipment was mounted on the bed of a machine and part on a traveling member. On paper the valves on the moving member fitted very nicely in a "pocket" on the under side. This caused no difficulty at

Circle 14 on Reader Service Card

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You can get AUTO-DIESEL Piston Rings QUICKLY!

While piston rings are a small item the delay in obtaining them when needed has stopped production and delayed delivery. This is very costly in many ways. Since 1921 hundreds of firms have been buying AUTO-DIESEL Piston Rings and getting QUICK delivery. In addition we can supply short runs at ATTRACTIVE PRICES. We specialize in this type of business. Can make up to 35" diameter for original equipment and for replacement in compressors, hydraulic cylinders, valves, etc. Will make circular parts to your specifications. Write for prices.

Reduce DOWN-TIME and EXPENSIVE REPAIRS

Use AUTO-DIESEL SCRAPER RINGS AN 6231 . . 1 to 71

Down-time always means the loss of production and expensive repairs. AUTO-DIESEL Bronze Scraper Rings assure longer life of components used with piston. They have been tested at 2,250,000 cycles and found to fit perfectly. Can supply in sizes from ½" to 13" I.D. We also make rings and circular parts for jet engines. Have Auto-Diesel Engineers help you with any piston ring problem. Write today.

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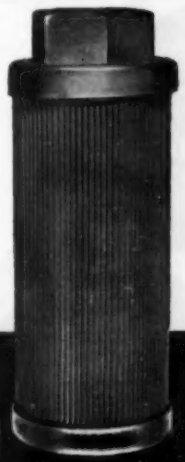
"RINGS and SHAPES Since 1921"

★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH



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WITH MONEL METAL INSERT

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SIZES AND SCREENS TO FIT YOUR NEEDS

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5837 South Ashland Avenue Chicago 36, Illinois

New! SANDERS "MINIVALVE"

MODEL SA-14

Compact
Lightweight
Non-Jamming
Low Input Power
Built-in Torque Motor
Wide Frequency Response

This miniature valve is an advanced design of a 2-stage hydraulic amplifier utilizing the "Bootstrap" principle to develop larger forces with low input power requirements. Its improved, self-clearing feature eliminates jamming.

SPECIFICATIONS:
Flow — 4 GPM for 1000 PSI drop across valve, System Pressure — 3000 PSI; Frequency Response — 100 cps. (Also available: "Minivalves" with flows up to 200 GPM.) Size — 1" x 1" x 3⅝"

For detailed specifications, write to Dept. A

SANDERS ASSOCIATES INCORPORATED
NASHUA NEW HAMPSHIRE

assembly because the moving member was assembled separately from the main machine. However, when the moving member, weighing some 5000 pounds, was mounted on the machine bed, the valves were completely boxed in. In fact it would have required a rubber arm four feet long to even touch a valve. It was necessary to burn a hand hole through the machine bed and reach in with one hand, working blind, to remove and replace a faulty solenoid.

The designer who stood by into the wee small hours while this important machine was put through its paces learned a lot about accessibility.

It would sound as if we are being critical of those who design machines to use air and hydraulic equipment. Actually, we are not criticizing individuals, but rather the circumstances which too often separate board and field problems. Too many problems which arise in connection with air and hydraulic equipment, at and after installation, are unknowingly designed into the system.

When the designer does not have an opportunity to get first hand knowledge of field conditions and problems, he must of course use his own best judgement. If his job is to design only and the responsibility for operation and maintenance is assigned to others, with no attempt at close contact, he cannot be blamed if occasionally his crystal ball fails. It would require considerable imagination and foresight for the man at the board to anticipate and account for the many field problems which confront maintenance. Some of these problems do not turn up until trouble develops months or even years after the engineering is completed. Corrections or modifications are then made, along with some uncomplimentary remarks about the eyesight, intelligence, and ability of engineers in general. But the poor guy who started the whole thing never finds out what he did or didn't do that resulted in difficulty. Why shouldn't he assume that he's doing O.K. and proceed to repeat when a similar job turns up.

Some plants have established training and instruction programs to acquaint personnel with air and hydraulic equipment. Too often these programs are based on the assumption that there is a broad and definite line between engineering and maintenance education. Unquestionably most of the work of maintenance is the result of normal wear and tear and unforeseeable breakdowns. However, part of the maintenance burden is that which has been imposed by poor design. Thus the maintenance training programs are partly designed "to lock the barn after the horse is stolen". They must learn not only to repair and restore equipment to operation, but to overcome unnecessary trouble that looked good to someone on a drawing board.

"But the cylinder did have a cushion"

Whenever possible and practical, it would seem advisable to recognize an overlap between maintenance and engineering problems and gear training programs accordingly. Likewise, means should be established to acquaint engineering with field problems as they may influence design.

It was mentioned earlier that trouble, though often costly, can have definite educational value. If the lesson learned from tracing and correcting trouble cannot be applied, the price of course is too high. Better it should work the first time and we go along feeling smug.

▼▼▼

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SAYBOLT SECONDS @ 100° F.

90 150 220

The new Cellulube series of fire-resistant hydraulic fluids — in 3 viscosity ranges — clears the way for many new applications.

In addition to fire resistance and excellent lubricity, Cellulube hydraulic fluids have the following advantages:

non-corrosive	low volatility
controlled viscosity	thermal stability
non-foaming	high boiling point

In the die-casting field, Cellulube 150 and 220 are already standard hydraulic fluids. Now Cellulubes find applications in . . .

furnace combustion controls in steel mills and oil refineries . . . coke ovens, furnace tilters, loaders and ingot carriers . . . electrical welders, extrusion presses, forging and multiple action presses.

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HYDRAULIC FLUIDS SPECIALLY ENGINEERED FOR SPECIFIC APPLICATIONS

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Piston Pumps

Two and Four Cylinder

- PUSH
- PULL
- LIFT

Positive Displacement
2500 P.S.I.

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Over 15,000 units in successful operation in a wide range of applications. Original equipment manufacturers are invited to write for descriptive literature and prices.

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COMPOUND
&
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"U" FLANGE
"O" RINGS

Periflex Inc.

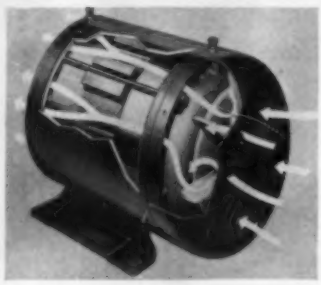
HAZEL PARK • MICHIGAN

New Products continued

ELECTRIC MOTORS
...in new NEMA sizes

Designation: Series 100

Features: Motors are designed with wide ventilation slots in stator outer periphery. The dividing fins, fitted against the steel frame, provide air passages for the free movement of fan-driven air. Efficient heat dissipation is achieved by the 50% greater contact between circulated air and stator core. A flow of cooling



air is supplied by a high-volume aluminum fan, and rotor fans create further air turbulence around the windings. True cartridge-type bearings are used. These are fully enclosed and protected against the entrance of dust from both the inside and outside of the motor. Bearings stay protected even when the end-plate is removed for motor inspection or servicing. When three screws are removed, the end-plate comes off independently of the cartridge's outbearing cap.

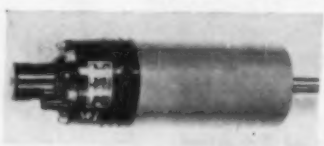
Howell Electric Motors Co.
Howell, Michigan

Circle 169 on Reader Service Card

AIR CYLINDER
...2-inch stroke

Designation: Model B-50

Features: Unit is capable of stroke lengths to 2 inches and thrusts of 300 lb. in either direction. It is suitable for supply pressures up to 100 psi with a conventional 3 to 15 psi



signal range. Compactness of unit makes it ideal for service where heavy loads require high accuracy positioning in a minimum of space. Cylinder is applicable for positioning proportioning pumps, electrical components, turbine and compressor governors, valves, etc.

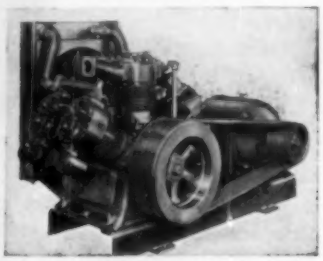
Conoflow Corp.
Philadelphia, Pa.

Circle 170 on Reader Service Card

AIR COMPRESSORS
...50, 75, 100 hp

Designations: 50S2. 75S2, 100S2

Design: Compressors of 55, 75, and 100 hp have displacements of 260, 415, and 550 cfm at 125 psi pressure. Balanced design reduces vibration and noise to a minimum. This prevents wear of both compressor and motor and reduces operating noise. Air cooling eliminates dangers of water stoppage or freezing.



Each bank of cylinders has individual intake filters. Forced feed lubrication by a positive plunger-type oil pump, adds to the service life.

Features: Standard equipment includes a dual-control giving the operator a choice of start and stop of both motor and compressor or a continuous running of motor with intermittent compressing. The latter selection permits the compressor cylinders to unload instead of compressing when desired pressure is reached.

Le Roi Division
Westinghouse Air Brake Co.
Milwaukee, Wisconsin

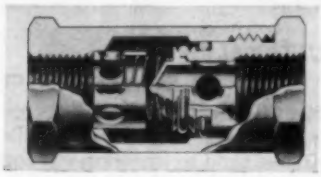
Circle 171 on Reader Service Card

CHECK VALVE
...has rugged construction

Designation: 200-1 Series

Design: Location of static O-ring body seal confines pressure to the strongest part of the body. Dead tight sealing and chatter-free operation result from using a resilient O-ring as the sealing member. Valve has cracking pressure of .5 to 1 psi, low pressure drop, and depend-

able leak-free reseating. Unit is suitable for use in a wide variety of vacuum and low pressure gas sys-



tems as well as high pressure pneumatic or hydraulic circuits. Bodies are of brass, aluminum, steel, or stainless steel. Valves are available in sizes from ⅛ to 2 inches.

James-Pond-Clark
Pasadena, California

Circle 172 on Reader Service Card

GAUGES
. . . of new construction

Designation: Supergauges, Solfrunts.

Design: Nylon-faced stainless steel segment with stainless steel pinion gives extended life under severe operating conditions. Construction permits easy removal of entire gauge assembly from case for inspection. Gauges are available in 4½, 6, and 8½-inch sizes in back-flange, front-flange, and turret-type cases.

Features: Superguages are available in cast case construction; Solfrunts have a solid front with safety blow-out back to protect workers. Construction ensures long life, accuracy, and readability which cannot be obtained in smaller gauges of drawn sheet metal design.

U. S. Gauge
Div. of American Machine & Metals
Sellersville, Pa.

Circle 173 on Reader Service Card

SERVO VALVE
. . . for 500 to 3000 psi

Design: Valve incorporates a floating armature located above two vertically placed nozzles. Because of this, only the torque output of the motor restricts the motion away from any one nozzle. This results in very high natural frequency for the motor. Dirt problems have been overcome by the use of over-size, positively bonded bronze, 5 micron filters, and by utilizing the unrestricted armature motion.

Performance: Because shuttle is fitted to the sleeve within millionths of an inch of the ideal clearance, performance is consistent with low leakage and high stability under extremes of temperature. Permanent magnet motor is exceptionally small. Required torque output and full hydraulic flow is obtained with differential currents of only 8 ma. maximum. Coils are available in a variety of configurations as to resistance, inductance, and operating current levels as required. Controlled maximum output flows are 0 to 9 gpm with a time constant of approximately 1½ milliseconds from input differential current to output flow.

Pacific Division
Bendix Aviation Corp.
North Hollywood, Calif.

Circle 174 on Reader Service Card

Continued on next page

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8261 New Champions of TOOL-O-MATION*
The best and latest in *tools, machines, inspection equipment, automation devices, controls and accessories to cut costs and boost profits—many never before shown anywhere.
For the small plant
For the intermediate plant
For the big plant
See them at ASTE's Greatest Show
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MARCH 19-23, 1956
Sponsored by the 32,000 men responsible for designing and selecting the best in production equipment. Write for advance registration blank today.
Equally important, plan to attend the 5-day, all-industry conference covering the latest developments in manufacturing techniques and equipment.
AMERICAN SOCIETY OF TOOL ENGINEERS
10700 Puritan
Detroit 38, Michigan

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WEAR-SAVERS THAT WON'T STEAL POWER

Hydraulic cylinder makers use Chicago Rawhide's Type G wiper seals for many reasons. Here's one: the special Sirvis leather wiper element holds its own lubricant—operates at low friction. This means negligible power loss. Another advantage: the Sirvis leather element will not trap grit and carry it—will not score the shaft. Years of dependable performance have demonstrated the ability of C/R Type G Oil Seals to exclude dirt, dust and moisture. They may be the answer to your problem, too. Write for your copy of "C/R Perfect Oil Seals."

C/R PERFECT Oil Seals

More automobiles, farm equipment and industrial machines rely on C/R Oil Seals than on any similar sealing device.

CHICAGO RAWHIDE MANUFACTURING COMPANY

1301 Elston Avenue OIL SEAL DIVISION Chicago 22, Illinois

IN CANADA: SUPER OIL SEAL MFG. CO., LTD., HAMILTON, ONTARIO

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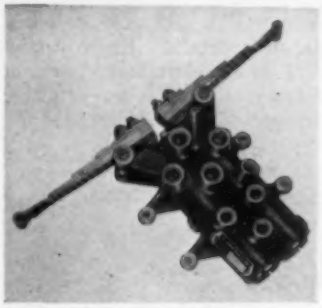
New Products / continued

MULTI-VALVE UNIT
. . . for aircraft brakes

Design: Single body contains four separate valves. Two of these handle hydraulic fluid to wheel brakes, and



the other two handle compressed air for operation of the unit. Valve pressure rating is 3000 psi. Size and weight of unit are a minimum and design simplifies installation in the airplane.

Gladden Products Corp.
Glendale, California
Circle 175 on Reader Service Card

HOSE CLAMP
. . . installed with pincers

Design: Clamp is round with U-shaped folds or lugs. Device is slipped on hose and crimped in place by squeezing parallel sides of lugs together. To remove the clamp, the lugs are snipped off. High working pressure is obtained by the initial permanent set of the clamp and the crimping action of the pin-

cers on the lugs amounting to cold working the piece. Although the modulus of elasticity is reduced, the allowable holding stress is increased.

Application: Clamp ensures lasting and positive clamping action with extreme hose pressure, movement, and tough usage. Hydrostatic

pressure tests on ⅞-inch OD wire braided hose using these clamps show no slippage or loss of clamping action at hose burst pressures ranging from 12,300 to 12,800 psi.

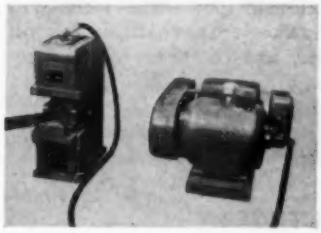
Circle Clamp Corp.
New York, N. Y.

Circle 176 on Reader Service Card

UTILITY PRESS
. . . 35 ton capacity

Application: Compact press is suitable for a variety of production and maintenance applications such as punching, shearing, angle iron notching, and forming of light gage metals.

Design: Unit has 1⅛-inch stroke and 1½-second operational cycle. Press is powered by 5-hp electric



motor and pump. Height of press is 22 inches. Combined weight of units is 620 lbs.

Manco Mfg. Co.
Bradley, Illinois

Circle 177 on Reader Service Card

HYDRAULIC CYLINDERS
. . . for 1 to 100 tons

Features: Cylinders are single or double acting and are available with different fittings for the piston end and for the top and bottom ends of the cylinder. Method of attaching the top and bottom ends assures that all parts of the cylinder subjected to the full hydraulic pressure are of the maximum proportions. V-packings adjusted by gland nuts form the joint between the top end fitting and the piston rod. Synthetic rubber seals are fitted to the piston. In single-acting rams the top fitting has the oil connection omitted and the V-packing is replaced by a bronze bushing. Strokes up to 36 inches are available. Cylinders with hollow rams for high pressures are applicable to loads from 7 to 85 tons. The hollow piston permits the cylinder to be used for pulling. The cylinders have been designed for 5000 psi but may be used at 6000 psi or at higher pressures depending on the stroke.

Chamberlain Industries Ltd.
London, England
Circle 178 on Reader Service Card

STANDS UP IN A CUP-KILLER

Sealing the seven hydraulic cylinders on this Shawnee Scout backhoe is exceptionally rugged duty. Operating at a pressure of 1200 psi with 30 to 40 inch strokes, a complete cycle occurs every 20 seconds. Temperatures go up to 180° F. in continual use. But C/R Conpor impregnated Sirvis leather cups handle this tough job. Even after hundreds of hours of such severe service no cup replacement is necessary. The reasons: Sirvis-Conpor cups have high tensile strength, excellent resiliency, and do not score or chatter. They operate over a wide temperature range and completely seal most oils, solvents and gases. For long cup "mileage" at low cost, look into C/R Sirvis-Conpor packings. Send for "Report on Conpor." Write A. P. Barth, Chicago Rawhide Mfg. Co., 900 N. State St., Elgin, Illinois.

C/R conpor
CONTROLLED POROSITY
SIRVIS MECHANICAL LEATHER

CHICAGO RAWHIDE MANUFACTURING COMPANY
1301 Elston Avenue SIRVIS DIVISION **Chicago 22, Illinois**
IN CANADA: DISTRIBUTED BY SUPER OIL SEAL MFG. CO., LTD., HAMILTON, ONTARIO
EXPORT SALES: GEON INTERNATIONAL CORP., GREAT NECK, NEW YORK

Other C/R products

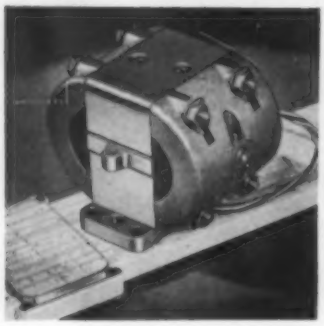
OIL SEALS: Shaft and end face seals for all types of lubricant retention and dirt exclusion • SIRVENE: (Synthetic rubber) diaphragms, boots, gaskets, and similar parts for critical operating conditions • SIRVIS: Mechanical leather packings and related products.

New Products continued

TORQUE MOTOR
. . . for servo valves

Designation: Model 21

Features: Motor is designed to drive hydraulic servo valves or other mechanisms which demand fast response and high output force proportional to input current. Motor is rated at 9 lbs force for 40 ma differential current. May be driven from two miniature output tubes in push pull, or from magnetic amplifiers.



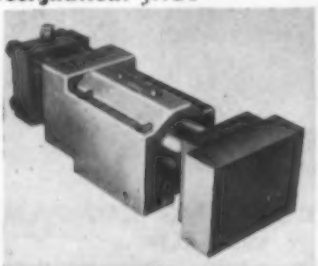
When magnetic amplifiers drive the motor, low impedance, high current coils are available to dissipate the same power.

Specifications: Motor stroke is ±.015 inch. Displacement sensitivity is ¾ inch per ampere, or 20 ma for full stroke. Unit weighs 18 oz. and is for operation from —65 F to 400 F.

Raymond Atchley, Inc.
Los Angeles, California
Circle 179 on Reader Service Card

CYLINDERS
. . . to 10,000 lbs

Designation: JACY



Design: Cylinders are produced in two types: a side-mounted series that is available in a variety of strokes, and an end-mounted series that is available in a single short stroke. Units are available in three capacities: 5000, 7000, and 10,000 lbs at 1000 psi.

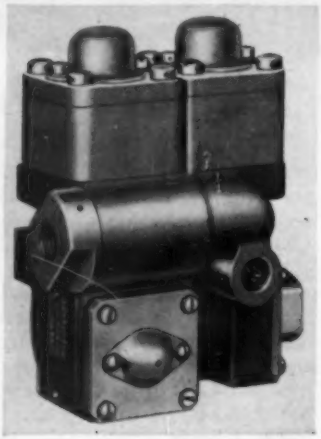
Application: Cylinders are especially designed to be mounted in a fixture or machine for press operations such as piercing, shaving, broaching, burnishing, staking, forming, dimpling, riveting, or clinching.

Modern Engineering Service Co.
Berkley, Michigan
Circle 180 on Reader Service Card

PRESSURE REGULATOR
. . . for electronic equipment

Designation: Model 12275

Features: Regulator is for controlling absolute pressure in electronic equipment containers, and is also suitable for other aircraft applica-



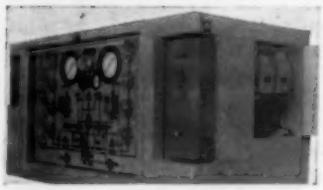
tions where absolute pressure must be maintained within close limits. Engine bleed air or other dry gases are used for its operation.

Specifications: Regulator meets requirements of Specification MIL-P-5518 and operates at inlet pressure from 35 to 250 psia with a flow of up to 10 liters per minute. Unit will maintain 15 to 19 psia and will sustain 13 G's in any direction. Regulator can be calibrated to meet different specific applications and can be adapted to inlet pressures of up to 1800 psi.

The Aro Equipment Corp.
Bryan, Ohio
Circle 181 on Reader Service Card

PORTABLE TEST STAND
. . . is completely self-contained

Features: Test stand permits testing up to eight different devices simultaneously at flow rates to 20 gpm and pressures to 5000 psi. An automatic cycling system is capable of 600 cycles per minute when used



for fatigue, life, and cycle testing. The test stand is powered by a 40-hp electric motor and includes a 100-gallon reservoir, air-type oil cooler, and complete instrumentation.

International Testing Service
Saginaw, Michigan
Circle 182 on Reader Service Card

OIL FILTER
. . . for 25 gpm flow

Designation: Flo-Pac

Construction: Filter element consists of 44 sq. ft. of heavy, resin-impregnated, accordion-pleated paper. This paper is formed around a perforated metal-center tube and enclosed in a treated paper cover.

Features: Unit can be used for a wide range of fluids. Completely inert, it will not remove additives found in many petroleum products. Paper element is unaffected by water, making it ideal for water emulsion fluids.

Specifications: Flow rate through the cartridge is 25 gpm for 170 SUS oil with an initial pressure drop of 1-½ psi. 98% of all particles 20 microns and larger are retained initially. In operation, smaller particles are removed as accumulated solids increase the efficiency of the cartridge.

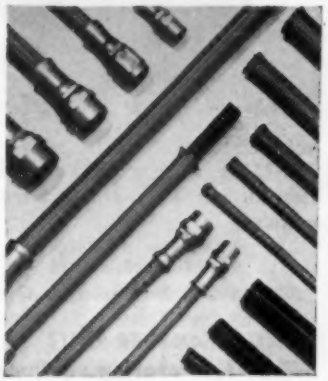
Houdaille-Hershey of Indiana, Inc.
Lebanon, Indiana
Circle 183 on Reader Service Card

TEFLON HOSE
. . . resists heat

Design: Hose comprises an inner core of Teflon which withstands high temperatures and is almost totally immune to chemical attack by solvents and corrosive fluids.

Formed directly onto the inner core is a braid of stainless steel wire which provides the core with a high temperature resistant support against high internal pressures.

Specifications: Hose has temperature range from —100 F to 450 F. Resists indefinitely chemical attack of corrosive fluids in new jet fuels and solvent action of lubrication and hydraulic fluids. Hose is approximately 45% lighter than rubber and OD is approximately 29%



smaller for same ID. Hose is available in assemblies with hose ranging from ¼ to 1¼-inch OD and standard aviation fittings including 45 and 90-degree elbows.

Titeflex, Inc.
Newark, N. J.

Circle 184 on Reader Service Card

PUMP

. . . for helicopter clutch

Designation: Model RG-6100E-1
Features: Unit pumps 5 gallons in 20 seconds with oil at 70 F. This is special intermittent duty requirement to assure proper function of hydro-mechanical clutch during en-

gine start. Pump is rated at 15 gpm continuous duty when oil is above 160 F.

Design: Pump is self-priming, rotary, four-blade, positive-displacement, non-pulsating type. Sliding blades are self-compensating for wear on the pump bore and are automatically free from variation in performance at extreme temperatures. Bore of pump is developed with multiple radii to cause inter-

Continued on next page

the NEW USG SUPERGAUGE®

...built to last a lifetime!

With proper application, the new USG Supergauge will last a lifetime!

SEGMENT—stainless steel, with nylon-faced gear section. Nylon-to-metal bond stabilizes the nylon against expansion and contraction . . . maintains accurate pitch diameter . . . assures proper mesh with stainless steel pinion under severe temperature and moisture conditions.

MONO-UNIT CONSTRUCTION—permits easy removal of complete gauge assembly for inspection and adjustment.

ARC-LOC MOVEMENT—permits all calibration adjustments of gauge assembly from rear without removing dial and pointer.

LEGEND ON DIAL—gives complete description of socket, Bourdon tube and movement material for ready identification.

MICROMETER ADJUSTABLE SELF-LOCKING POINTER—permits accurate repositioning of pointer.

These features are also available in USG Solfrunt Gauges with solid front construction.

Supergauges available in 4½", 6", and 8½" sizes. For complete information on case styles, materials of construction and connections write for Publication 1819.

UNITED STATES GAUGE USG *Gauge Headquarters* FOR OVER 50 YEARS

United States Gauge, Div. of American Machine & Metals, Inc., 111 Clymer Ave., Sellersville, Pa.

Circle 136 on Reader Service Card

New Products continued

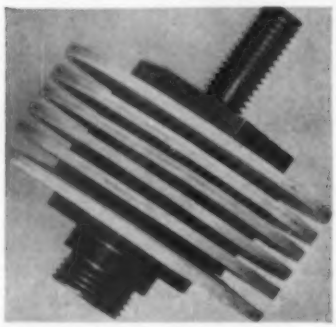
mittent sliding of blades in rotor slots. Pump displacement is 1.54 cu. in. per rev. with a capacity of 900 to 1000 gph at 10 psi and 2500 rpm. Shaft seal is a stationary seal disk and revolving seal plate mounted together on synthetic rubber O-rings. No leakage of the shaft seal is present at the lowest drain port.

Lear, Inc.
Lear-Romec Div.
Elyria, Ohio

Circle 185 on Reader Service Card

OIL FILTERS
. . . of Teflon & Kel-F

Features: Porous fluorocarbon filters are of all welded construction with molded flow passages and are

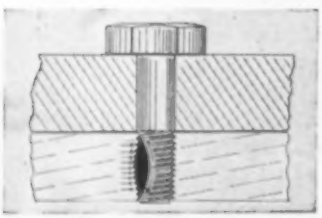


designed for easy disassembly and cleaning. Compactness is achieved with 1 sq. ft. of filter contained in a volume 2 inches high and 3½ inches OD. Sizes to 10 sq. ft. are available.

Porous Plastic Filter Co.
Glen Cove, New York

Circle 186 on Reader Service Card

SELF LOCKING THREADS
. . . eliminate safety wires, locknuts



Features: Screw thread remains distortion free and can be repeatedly removed and replaced with adequate locking torque and complete absence of galling of threads. Dimensions fit standard nuts and locking feature can be added to any type of standard screw for custom threaded applications.

Design: Locking action is achieved by convex fibre insert in the thread of the bolt. This ensures locking action along the entire length of insert against the nut or female thread. Locking action does not require high torque, or special tools, and may be used with standard nuts, plate nuts, or tapped holes.

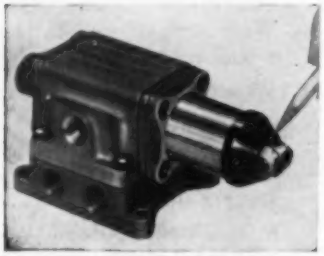
Starloc, Inc.
New York, New York

Circle 187 on Reader Service Card

CAM VALVE
. . . with larger plunger

Designation: Models 2051, 2054

Design: Heavy duty valve has larger cam roller and plunger for increased bearing surface and longer life. Plunger spring is loaded to take care of overtravel on stroke, and all work-



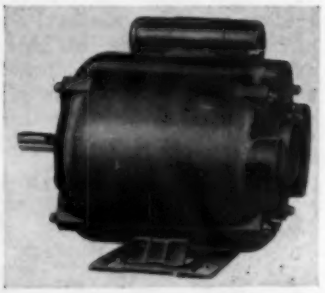
ing parts are completely sealed. Unit is especially applicable for foundries or locations where sand, dirt, or dust are present. Model 2051 is ⅜-inch 4-way; model 2054 is ⅜-inch 3-way.

Mechanical Air Controls, Inc.
Detroit, Michigan

Circle 188 on Reader Service Card

SINGLE PHASE MOTORS
. . . dual voltage, ball bearing

Design: Motors are equipped with ball bearings and have aluminum injection molded, one-piece, squirrel cage rotors dynamically balanced for vibration-free operation. Stator has a high efficiency core of laminations precision punched from high grade electrical sheet steel. Motors are offered at approximately same price as sleeve-bearing, single-



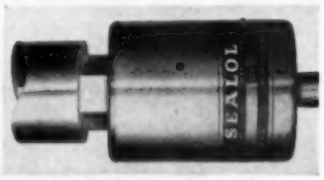
voltage motors. Available in ¼, ½, and ¾ hp at 1200, 1800 and 3600 rpm for 115/230 volt, 60-cycle operation.

ACEC Electric Corp.
New York, New York

Circle 189 on Reader Service Card

FLUID TRANSFER UNIT
. . . for rotating equipment

Features: Unit is for transferring fluids under pressure from a stationary source to rotating equipment. Transfer is rated at 1000 psi



and 10,000 rpm shaft speed. Construction features include shielded, prelubricated bearings and standard balanced-pressure seals.

Application: Typical applications are on deep or precision hole drilling equipment for transferring coolant to the drill point for chip removal and for cooling cutting edge. Also used to transfer pressurized fluid to cylinders or clutches.

Sealol Corp.
Providence, R. I.

Circle 190 on Reader Service Card

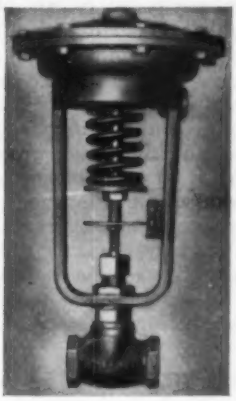
DIAPHRAGM VALVE
. . . for air & liquids

Designation: Series 400

Design: Valve has high-tensile cast iron yoke with cast iron diaphragm plates. Diaphragm is neoprene with cotton insert for operating temperatures up to 160 F. Spring is alloy steel with parallel squared and ground ends. Nominal spring range of 3-15 lb is standard. Recommend-

ed maximum working air pressure rating is to 50 psi.

Features: Valve types are double seated, single seated, and three-way. Body is rated at 125 psi, except single-seated, bronze body which is 150 psi. Single-seated valves for throttling or on-off control have seats in which diaphragm force



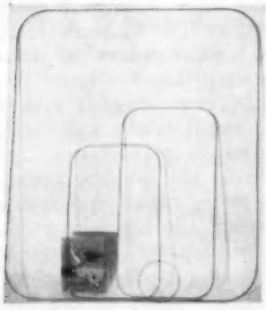
tends to close plug, and flow tends to open plug; or diaphragm tends to open plug, and flow tends to open plug.

Minneapolis-Honeywell Regulator Co.
Philadelphia, Pennsylvania

Circle 191 on Reader Service Card

METALLIC O-RINGS
. . . in rectangular shapes

Features: Rectangular O-rings recently produced on order have measurements of 46½ x 55½ inches with 6-inch corner radii. Material is 321 stainless steel tubing, 3/16-inch cross section and .020-inch wall thickness. Other configurations can be triangular, compound or any variation. O-rings are for static sealing applications. Once the O-rings have been installed there is no need for tear-down for replacement due to cure-date expiration. The proper



metal or finish plating can be specified for sealing against corrosive liquids and gases at high or low temperatures and pressures.

United Aircraft Products, Inc.
Dayton, Ohio

Circle 192 on Reader Service Card

MARSH *Thermo* LEATHER PACKINGS

IMPREGNATED WITH SYNTHETICS!

616:

312:

MARSH BEST SINCE 1900 LEATHER PACKINGS

A Custom Treatment for Every Packing Job!

CUP PACKING

NON-EXTRUSION WASHER

DIAPHRAGM

U PACKING

VEE PACKING

FLANGE PACKING

ENGINEERED TO YOUR SPECIFIC REQUIREMENTS

616: Has a synthetic rubber impregnated into thermo leather. Temperature will not take out this rugged treatment. At the same time it stays flexible at low temperatures of —65° without becoming hard or brittle. 616 is very resilient, springy and tough . . . resists abrasion. Used for oils, new synthetic fluids, aircraft oils, air service and resists solvents.

Makes very fine cups, vees, "U" packings, flange packings and non-extrusion back-up washers.

312: Has a synthetic impregnated into the thermo leather, one of the first developed by Marsh. It is the accepted standard in many hydraulic and pneumatic installations. Its temperature range is satisfactory for most standard applications. This utility treatment makes fine cups, flange packings and "U" packings. It is a resilient but firm packing. Used for air, oil and water service.

Marsh has developed many treatments of different combinations for leather packings. Marsh has the know how of half a century in packing manufacture and can help you with your special problem.

Thermo leather without any treatment will withstand the highest temperature range of any other known leather. It is condensed in both area and thickness to create toughness and high tensile strength. It remains permanently flexible without drying out or becoming hard. No special lubricants required.

We produce packings to adopted dimensional standards.

Write for engineering and technical data.

C. W. MARSH COMPANY

MAIN OFFICE AND FACTORY • MUSKEGON, MICHIGAN

SALES OFFICES: 75 E. Wacker Dr. Chicago 1, Ill. · 101 Park Ave. New York 17, N.Y. · 548 S. Border Rd. Winchester, Mass. · 1900 Euclid Ave. Cleveland 15, Ohio

Circle 91 on Reader Service Card

HOW YOU SAVE . . .

. . . getting drier Compressed Air

● Save the cost of cooling water and you save the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, you get drier compressed gas or air for your process. You get better operation and lower costs in the use of all air-operated instruments, machines, or paint sprays. You save expense for piping, pumping, water treatment and disposal. You get the use of badly needed water elsewhere in your plant.

Niagara Aero After Cooler cools compressed air or gas (evaporatively) below the temperature of surrounding atmosphere, with no further condensation in your air lines.

Write for complete information; ask for Bulletin No. 98, or contact nearest Niagara Engineer if you have any problem involving the industrial use of air. Address Dept. AH.

NIAGARA BLOWER COMPANY
405 Lexington Ave., New York 17, N.Y.
District Engineers
in Principal Cities of U. S. and Canada

Useful Literature continued

FLOW CONTROL VALVES . . . for aircraft applications are presented in a data sheet on the Series 1100 line of Aircraft Products Co. These fixed-type valves are for pressures up to 3000 psi. The fixed two-way provides precise flow metering in both directions and contains a fixed orifice in the center and .008-inch mesh stainless steel filters on either side. The fixed one-way type meters in the restricted flow direction and permits full line flow at low pressure drop in the free flow direction. It contains an orificed poppet with an integral filter. The valves which weigh considerably less than conventional models, can be supplied in standard models for use within ambient temperature ranges from −65 F to +275 F. Special models can be furnished to withstand ambients up to 400 F. The data sheet shows dimensions and gives weight, material and pressure specifications for the two types of valves.

Circle 217 on Reader Service Card

TUBE FLARER . . . Catalog 1145A12 from Parker Appliance Co. includes operating instructions and a parts list on their Model 232B power tube flarer. This is an electric motor driven machine for production flaring of annealed seamless copper, aluminum, steel, or stainless steel tubing. With interchangeable heads and accessory attachments, it can be used for squaring, burring, and beading of tubing. The flarer handles the full range of standard tube wall thicknesses and all sizes from ⅛ through 2-inch OD. With a variable speed pulley, the speed of the rotary flaring center can be controlled to suit the weight and material of tubing being flared. The catalog contains illustrations of the various operations that can be performed on the machine.

Circle 218 on Reader Service Card

LIMIT SWITCHES . . . are detailed in preliminary data sheets 104 and 105 offered by Micro Switch Div. of Minneapolis-Honeywell Regulator Co. The two data sheets describe a small 2-circuit limit switch and a double-pole, double-throw environment-free switch for airborne applications. This small completely sealed, cylindrical switch is for use on landing gears, flaps or other exposed locations of aircraft. The unit measures 1 inch in diameter and 2 inches long. The 2-circuit switch is enclosed in a rugged aluminum housing which protects the switch from physical damage, offers a means of mounting, and provides a fitting for connecting conduit. An O-ring seal on the actuator shaft and a gasket between the cover plate and enclosure prevent foreign matter from entering the switching chamber.

Circle 219 on Reader Service Card

AIR FILTERS . . . and lubricators manufactured by Master Pneumatic, Inc. are discussed in a catalog from the company. Material is included to give data on the savings made possible by correct air filtration and lubrication at every air drop ahead of every air tool. New principles of air filtration now employed in industry are discussed and illustrated. A section is devoted to a new unit which automatically empties filters and other containers of trapped liquids and sludges, with completely positive, non-sticking action. Filter and lubricator installation and maintenance are covered in detail and a dimensions sheet and parts list are included.

Circle 220 on Reader Service Card

SPECIALTY STEELS . . . are discussed in a 32-page booklet prepared by The Carpenter Steel Co. The booklet defines the distinctive characteristics of a broad range of special purpose steels in terms of end use. It briefly summarizes the company's specialty product line, covering tool and die steels, stainless steels, silicon and high nickel electrical alloys, special purpose alloy steels, valve, heat-resisting and super alloy steels, tubing and pipe in various analyses, and fine wire specialties. Tubing is full finished. It is annealed and pickled for maximum corrosion resistance and ductility. OD and ID flash are removed for uniform wall thickness to meet standards for heat exchanger uses.

Circle 221 on Reader Service Card

AIR COMPRESSORS . . . using the feather valve principle are the subject of Bulletin L-676-B1A released by Worthington Corp. Each feather valve consists of light strips of steel whose easy flexing permits passage of air. The valve seats merely by increasing contact from each end to the center, not by destructive impact. Information and illustrations are included on component parts including frame, running gear parts, intercooler, crosshead, motor, and main bearings. Various full-page cutaway views are shown. A two-page diagram illustrates correct selection and coordination of all auxiliary equipment used in a typical installation and photographs are included to show actual compressor installations.

Circle 222 on Reader Service Card

HYDRAULIC COMPONENTS . . . Vickers, Inc. have released their new 56-page Catalog No. 5001A describing their complete line of oil-hydraulic pumps, controls, and accessories for general industrial application. The catalog includes engineering, design, and application information relating to pumps, pressure controls, volume controls, directional controls, control assemblies, hydraulic motors, transmissions, cylinders, and hydraulic accessories. The catalog describes each unit in detail, shows a photograph, cutaway view, and typical circuit drawing where required. Application recommendations, and data relating to the selection, purchase and application of the equipment is included. Tables showing model designations, ratings, and capacities, as well as typical performance curves are presented.

Circle 223 on Reader Service Card

SOLVENT RESISTANT MATERIAL . . . called "Compar" and manufactured by Resistoflex Corp. is presented in the company's Bulletin COM-1. The material is abrasion resistant and flexible and is entirely unaffected by all water insoluble liquids including those which attack solvent resistant synthetic rubber formulations. Applications of the material in the form of hose, hose assemblies and a variety of molded products are discussed. The material has a temperature range of —20°F to 190°F. Hose or hose assemblies using the compar construction are available. The extremely long flex life of the material makes it an ideal valve diaphragm material for organic solvents and chemicals which deteriorate synthetic rubber diaphragms.

Circle 224 on Reader Service Card

THERMOCOUPLES . . . Minneapolis-Honeywell Regulator Co. has released Specification Sheet 57 which describes new two-wire thermocouples with outside diameters of ⅛ and 3/16-inch. These are for use where space is limited and sensitivity and accuracy are important. They are available in lengths from 6 to 72 inches and can be furnished with small, open terminal block assembly, general purpose head, or screw-cover terminal head assembly. The thermocouples are for temperatures up to 1200 F in various ranges with accuracies from ±6 degrees to ±½%.

Circle 225 on Reader Service Card

STAINLESS TUBING . . . a product of The Babcock & Wilcox Co. is presented in their Bulletin TB-355. Included in the bulletin are

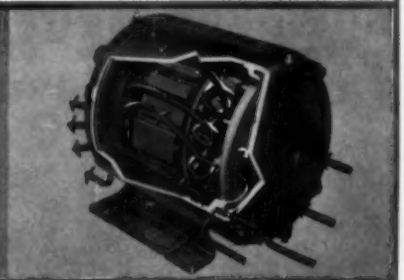
Continued on next page

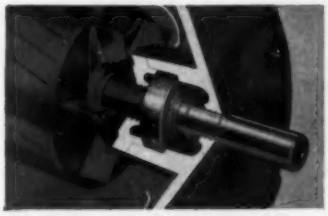
to HYDRAULIC ENGINEERS, Howell suggests

What to look for in the new re-rated motors

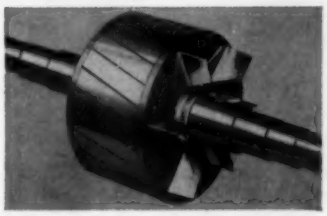
Want pump or compressor motors with all the space and weight-saving advantages of the NEMA re-rated frame size plus labyrinth-type ventilation to make them truly splash-proof? Below are some points for comparison and a few of the reasons why the new Howell "Series 100" motors are so outstanding!

VENTILATION . . . "Cool running" means long life in motors. The steel shell of a Howell motor and a new stator design with the largest air passages yet devised put ample ventilation where it's needed. Compare!





BEARINGS . . . They should be fully protected. Dirt can't enter Howell's double shielded bearings either from inside or outside the motor, because they are sealed in the end plate cavities by dust-tight inner caps. Compare!



COPPER-CLAD ROTORS . . . Howell motors have copper-clad rotors. This means better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your special requirements. Compare!

Above: Construction details of the new Series 100 Splash-Proof Motor. Left: the Totally Enclosed Fan-Cooled Motor.

HOWELL MOTORS

Howell Electric Motors Company, Howell, Michigan

PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

"Quality without compromise"

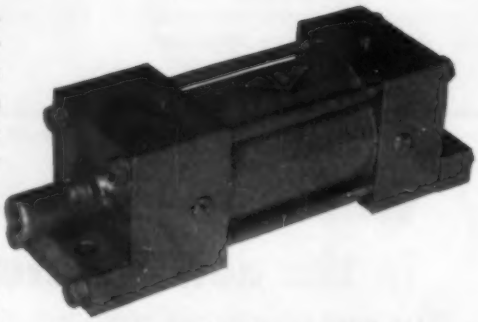
JLE

JLE SQUARE CYLINDERS

The full line from 1½ to 16 in. bores is available with interchangeable stock mountings and automatic cushioning action on standard types (Adjustable valve cushioning on special types.)

The Square Cylinders are designed for low and medium pressure air and oil service, 250 psi pneumatic, 500 psi hydraulic.

MEETS J. I. C. STANDARDS



The JLE Square Cylinders are simply designed, exceptionally rugged and built of highest quality materials, which insures top performance at lowest possible cost.

"WORKHORSE" AIR CYLINDERS

TYPE AD-5-DA TYPE BD-5-DA TYPE CD-5-DA TYPE DD-5-DA

JLE "Work-Horse" Air Cylinder—the dependable cylinder at a "Work-Horse" Price! Developed for our own use, the cylinder is designed for pressures to 250 psi. The "Work-Horse" Cylinder is available in bore sizes from 1½ to 10 in., in four standard mountings and furnished in both cushioned and non-cushioned models.

Send for the new JLE Cylinder Catalog HP 110

JAMES L. ENTWISTLE CO.

PLANT and EXECUTIVE OFFICE:
1475 ELMWOOD AVE., CRANSTON (PROV. 7), R.I., U.S.A.

Useful Literature / continued

tables of analyses, mechanical properties, creep strength, physical properties, and oxidation resistance of nine of the most popular stainless steels. Properties of the tubing including corrosion resistance, high and low temperature strength, and workability are discussed. The information explains that with the use of greater power and slower bending speeds, properly annealed stainles tubing and pipe may be bent or coiled to about the same radii as carbon steel.

Circle 226 on Reader Service Card

SAMPLING VALVE . . . for installations where it is desirable to have the valve seat inside the wall of a vessel in order to prevent liquid from remaining in the nipple and valve is covered in Data Unit 270 presented by Jerguson Gage & Valve Co. The rugged valve has an outside screw and yoke construction to meet high temperature or corrosive conditions where inside threads cannot be tolerated. The design eliminates possible freezing and allows the valve stem to work freely at all times. Standard connections are ¾-inch weight is 4½ lbs. The valves are recommended for 4000 psi at 100 F and 1000 psi at 750 F.

Circle 227 on Reader Service Card

SILICONE RUBBER . . . designated Silastic and manufactured by Dow Corning Corp. is presented in a recent release from the company. The brochure is divided into five sections detailing properties and performance of the material as affected by extreme temperatures, weathering, compression, chemicals, and dielectric service. Resistance to various oil is indicated in a chart, and a graph of compression set vs. temperature compares the silicone material to organic rubber. The results of tests of the effect of heat aging on flexibility and hardness are given.

Circle 228 on Reader Service Card

FLUID DRIVE . . . using steel shot as the fluid is covered in Bulletin A-640 recently issued by Dodge Manufacturing Corp. A measured amount of the shot is contained in the housing which is keyed to the motor shaft. When the motor is started, centrifugal force throws the

flow charge to the perimeter of the housing wedging it between the housing and the rotor which transmits power to the load. The bulletin contains cross-section engineering drawings of the drive, named Flexidyne, and includes dimensional drawings of the drive and coupling with explanation of the flow charge (shot), and the thermal protecting unit.

Circle 229 on Reader Service Card

FITTINGS, VALVES, TUBING... products of High Pressure Equipment Co., Inc. are detailed in the company's Catalog No. 2055. Included in the catalog is information on two and three-way manual valves for pressures up to 60,000 psi. Other equipment includes couplings, adapters, gauge connectors, check valves, and reducers. Connectors for flareless fittings are installed on square-cut tubing by tightening a nut against a definite stop with no danger of overtightening.

Circle 230 on Reader Service Card

LIMIT SWITCHES . . . products of Unimax Div. of The W. L. Maxon Corp. are the subject of 24-page catalog 655 issued by the company. Switches discussed in the catalog include high-sensitivity, metal cased, immersion-proof, general purpose, AN-type, JAN-type, direct-current, and sub-miniature. A complete pictorial index aids in quickly selecting the right switch for any application. Each switch is presented with photographs and detail drawings, different types of actuators available, base and terminal data, physical dimensions, operating characteristics, and electrical ratings.

Circle 231 on Reader Service Card

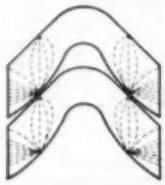
TUBE BENDING . . . a comprehensive service available from Tube Specialists of California is described in literature available from the company. The service includes an extensive machine selection for all standard methods of bending, beading, flaring, flanging, cutting, deburring, notching, metering, flattening, punching, swaging, expanding and profiling of all ferrous and non-ferrous tubing to 6-inch OD. Three other operations are available including vapor degreasing to protect finished parts against absorption and corrosion, pressure testing, and inspection to ensure adherence to specifications.

Circle 232 on Reader Service Card

R/M VEE-FLEX®

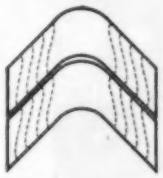
America's most copied packing

GIVES YOU SEALING LIKE THIS



Simplified diagram of stress trajectories in R/M Vee-Flex Rings with convexly curved surfaces.

INSTEAD OF LIKE THIS



Simplified diagram of stress trajectories in ordinary V-type rings with flat contact surfaces.

The success of R/M Vee-Flex, outstanding in hydraulic service, is due to its special design, which distributes pressure laterally against the stuffing box wall and shaft as well as longitudinally against the next ring. This is accomplished by R/M's unique convexly curved surface on the pressure side of the packing. Photo-elastic analyses,* corroborated by radial pressure tests,* prove that maximum sealing performance occurs at a point slightly below mid-width on the sealing area. For complete data, including a table of sizes, write for R/M Vee-Flex Bulletin. And if you have a packing problem, call on R/M's specialized engineering service.

**Performed at The Franklin Institute Laboratories for Research and Development*

R/M **PACKINGS**

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, PASSAIC, N.J.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks Clutch Facings • Fan Belts • Radiator Hose • Bowling Balls

Circle 111 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

John H. Allen
The Weatherhead Company

John H. Allen has been appointed industrial distributor sales manager of **The Weatherhead Company.** Allen has a ten year background with the industrial marketing and sales field and served most recently as assistant manager of distributor sales for the Blackhawk Mfg. Company.

Robert L. Firth
Electrol Incorporated

Electrol Incorporated has elected **Robert L. Firth** as vice president in charge of marketing. Prior to joining Electrol, Firth was for ten years associated with the New York Air Brake Company, serving as staff manager, sales promotion and advertising.

Rivett Lathe & Grinder, Inc., has named **Schroeder Brothers,** Pittsburgh, as representative in the western Pennsylvania and West Virginia area. The company has separate engineering department, warehouse and fabricating department and sales department.

Dr. Thomas G. Harris
International Packings Corp.

International Packings Corporation has appointed **Dr. Thomas G. Harris** as supervisor of the Leather Division's Research Laboratories. He was previously research chemist for the Chemtan Company. While associated with the Institute of Research at Lehigh University, Dr. Harris worked on programs sponsored by Devoe and Reynolds Company and by Catalin Corporation of America.

R. N. Boucher, sales manager in the New York district for **Parker Appliance Company,** has been transferred to Cleveland. He has been assigned as special representative to contact U. S. Government facilities. Boucher will be responsible for all direct government business and for product specification negotiations for the Tube and Hose Fittings, Industrial Hydraulics and Rubber Products Divisions. **J. G. Watson** will succeed Boucher in New York. He was previously sales engineer in the Philadelphia area.

John R. Curran has been elected vice president of the **Hammel-Dahl Company.** Joining the organization in 1945 as design engineer, Curran has served as chief design engineer and director of engineering.

Roylyn, Inc., has named **Jack L. Sorenson** as aircraft sales manager and **Port Turner** was appointed sales representative in San Diego County. Turner will also cover Imperial County and the state of Arizona.

The sales headquarters of the **Packing Division of Raybestos-Manhatten, Inc.,** have been moved from Manheim, Pa., to Passaic, N. J. **R. B. Hazard,** sales manager, located at the new office, announced the following appointments. **John McKinley,** special

Continued on page 160

ANNOUNCING THE NEW LINE OF PALLEY HYDRAULIC CYLINDERS

CUSTOM BUILT AT MASS PRODUCTION PRICES

Our 10 years experience in filling the needs of Aircraft and Heavy Industry for Hydraulic Equipment have led us to the engineering and development of this all new line of Industrial Hydraulic Cylinders. Designed especially to meet the most rigid requirements of industry. All are double action with rugged steel construction throughout. Made to take pressures up to 1500 PSI and 3000 PSI. Utilizing standard 'O' rings with leather back-up rings on the 3000 PSI types. Have male clevis mounts on both ends.

We are also equipped to Custom Manufacture to your specifications. Write us Today for further details or expert advice on your problems.

PART NO.	BORE	STROKE	SHAFT	PSI	Type of CAP	THRUST	PRICE
PH34E	3"	4"	1-1/8"	1500	External Threaded	10,500 lbs.	$32.50
PH36E	3"	6'	1-1/8"	1500	" "	"	35.00
PHE1	3"	8"	1-1/8"	1500	" "	"	37.50
PH312E	3"	12"	1-1/8"	1500	" "	"	42.50
PH341	3"	4"	1"1/8"	1500	Inserted	"	32.50
PH381	3"	8"	1-1/8"	1500	"	"	35.00
PH45E	4"	5"	1-1/8"	1500	External Threaded	18,750 lbs.	37.50
PH46E	4"	6"	1-1/8"	1500	" "	"	39.50
PH48E	4"	8"	1-1/8"	1500	" "	"	43.50
PH410E	4"	10"	1-1/8"	1500	" "	"	47.50
PH412E	4"	12"	1-1/8"	1500	" "	"	51.50
PH45E3	4"	5"	1-1/2"	3000	" "	37,500 lbs.	52.50
PH46E3	4"	6"	1-1/2"	3000	" "	"	54.50
PH48E3	4"	8"	1-1/2"	3000	" "	"	58.50
PH410E3	4"	10"	1-1/2"	3000	" "	"	62.50
PH412E3	4"	12"	1-1/2"	3000	" "	"	66.50
PH518I	5"	18"	2"	3000	Inserted	59,250 lbs.	85.00
PH524I	5"	24"	2"	3000	"	"	107.50
PH530I	5"	30"	2"	3000	"	"	130.00
PH636E	6"	36"	2"	3000	External Threaded	86,625 lbs.	265.00

4-WAY, OPEN CENTER HYDRAULIC CONTROL VALVE

Has built-in adjustable relief valve, set at 1000 PSI with a spring loaded neutral position. Used for controlling (1) double action cylinder of the types shown in this advertisement. Can also be mounted in series. Has 3/4" standard pipe inlet & outlet ports. 1/2" pipe thread cylinder port. Shipping weight 10-1/2 pounds. . . . . **21.50 NEW**

NEW - HEAVY DUTY HYDRAULIC CYLINDER

A rugged, heavy duty cylinder. All steel construction. Double action. Has 7" bore. 13" stroke. 2½" steel shaft. Ideal for use in hydraulic presses, leveling ramps, hydraulic tail gates, industrial machinery, road machinery, etc. Shipping weight 180 pounds. . . **95.00**

GB-8-25 TON HYDRAULIC CYLINDER Same as above except has 8" bore, 15" stroke. Will give 50000 lbs. thrust at 1000 PSI. Shipping weight 185 lbs. **105.00**

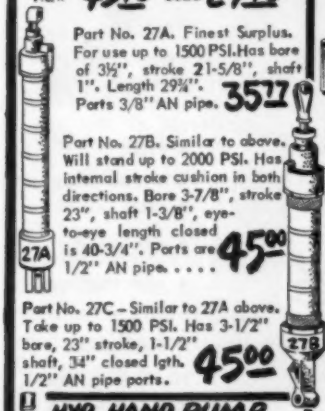
SAVE UP TO 85% ON GOV'T SURPLUS

Special

SURPLUS HYD. CYLINDERS

Gov't Surplus Bargain. Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air system cylinder. Has a 4" bore, 18" stroke, 30½" length. Part No. 29. New & Used.

NEW **43.95** USED **29.95**

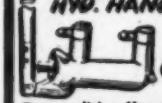


Part No. 27A. Finest Surplus. For use up to 1500 PSI. Has bore of 3½", stroke 21-5/8", shaft 1". Length 29¾". Ports 3/8" AN pipe. **35.77**

Part No. 27B. Similar to above. Will stand up to 2000 PSI. Has internal stroke cushion in both directions. Bore 3-7/8", stroke 23", shaft 1-3/8", eye-to-eye length closed is 40-3/4". Ports are 1/2" AN pipe. **45.00**

Part No. 27C – Similar to 27A above. Take up to 1500 PSI. Has 3-1/2" bore, 23" stroke, 1-1/2" shaft, 34" closed lgth. 1/2" AN pipe ports. **45.00**

HYD. HAND PUMP



12.75

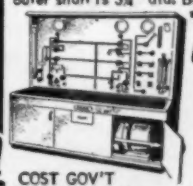
Top condition. Has operating pressure of 1500 PSI. Capacity of 1.5 cu. in. per complete cycle.

HYD. HOSE & TUBING

We stock a complete line of Hydraulic Tubing and Hose as well as all types of fittings and hardware. Send us your requirements.

TELESCOPING HYDRAULIC CYLINDER

Thrust shaft is in two stages. First stage extends 39" – the second stage extends 18". Each stage works seperately. The overall length eye-to-eye is 61½". Inner shaft is 2-3/4" dia. outer shaft is 3¼" dia. Bore is 4½". Ports are 1/2" AN pipe. **165.00**



COST GOV'T APPROX. $6000 **$1495**

AIR ASSOCIATES HYDRAULIC TEST STAND

Electric motor driven type. Has a 2500 PSI Hydreco Pump which delivers up to 10 GPM. Powered by 15 HP, 3 phase motor using 220/440 volt, 60 cycle current. Unit has selector valves, pressure gauges, flow meter, reservoir, heat exchanger and filter pressure regulator. Mounted on steel frame. Has work bench, flourescent lights and hand operated, high pressure pump for testing to very high pressures. Overall size: 8ft. long x 7ft. high x 4ft. deep.

HYD. TEST STAND – Same as above but has a Reeves variable speed reducer to control the pump output as desired. **$1895**

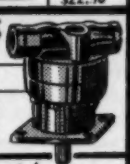
SURPLUS VICKERS PISTON TYPE-CONSTANT SPEED-HYD. PUMPS & MOTORS

Made to top Aircraft specifications. RPM shown below is the recommended maximum for constant speed. Quantities limited.

Part No.	Cu. in. per rev.	GPM	PSI	RPM	PRICES NEW	PRICES USED
HYDRAULIC PUMPS						
PF9-713-20BCE	.410	5.3	1000	3000	—	$20.00
PF9-2713-20ZE	.410	5.3	1500	3000	$24.50	—
PF9-2713-10Z	.208	2.7	1500	3000	$29.75	$22.50
PF2-713-25BCE	.507	6.5	1000	3000	$32.50	$22.50
PF50-3915-30YG	1.520	19.7	3000	3000	—	200.00
HYDRAULIC MOTORS						
MF9-713-15A	.310	4.46	1000	3750	—	$18.50
MF9-713-30BCF	.600	9.75	1000	3750	$37.50	—
MF9-713-25BCF	.507	8.25	1000	3750	—	$22.50

STRATO POWER HYDRAULIC PUMPS

Designed and built to finest aircraft specifications.



PART NO.	GPM	PSI	RPM	PRICE EA.
SP-3	2	1400	3750	NEW $27.50
67WF300	3	1500	4500	USED 72.50
67WJ800	8	3000	4500	USED 87.50

NEW 10 TON HYDRAULIC PRESS

Here is a rugged 10 TON Arbor Press you can use in the shop or take with you on the job. Has sturdy frame of 4" welded channel iron. Press has 4-1/4" stroke, 2-1/2" diameter ram. A control valve operates the piston in both directions. Platform is adjustable. Has positive power Hand Pump. 2000 PSI pressure gauge. NEW **129.00**

NEW SURPLUS VICKERS HYDRAULIC TRANSMISSION

Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic pressure dash pot for smooth control. Power output RPM is 0 to 1/3 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Ideal for Lathes, Duplicator set-ups, Conveyors, Drives, etc. . . . **44.50**

4" **SPLINE SHAFTS** for input and power take-off on above. $2.50 pair

INPUT & TAKE-OFF PLATE ASSEM. To adapt trans. to pulley drive. Has high speed bearings and 1/2" keyway shaft. Per Set **20.00**

PESCO HYD. PUMP

A gear type pump. Will deliver 2 GPM at 1500 RPM with 1500 PSI – delivers 6 GPM at 4300 RPM with 1500 PSI. Has .375 cu. in. displacement per rev. Ports are 3/4" standard pipe. 5/8" male spline drive shaft. 4" pad mount. In good condition. **14.95**

NOTE: Items shown here are only a small part of our tremendous stocks. We have over 100,000 Hydraulic Cylinders in 106 sizes and types. Also all type Valves, Pumps, Motors.

Palley SUPPLY CO

Order from this Ad. Pay by Money Order or Check. P.O.'s accepted from well rated D&B firms. 1/2 Dep. with C.O.D.s. Prices F.O.B.

2263 E. VERNON AVE., DEPT. AH-10 LOS ANGELES 58, CALIFORNIA

Circle 115 on Reader Service Card

NEW

Hydraulic Operation and Control of Machines

Ian McNeil

INDISPENSABLE new operating handbook and reference guide for the practicing engineer working with hydraulic equipment of all kinds. Organizes in easily accessible form essential information needed in solving operation and maintenance problems of hydraulically driven machinery.

Both established methods and important new developments are thoroughly described, and future trends are indicated. Merits and relative costs of various types of equipment receive special attention.

Covers: hydrostatics; pumps and motors; valves and circuits; power-saving devices; use of hydraulic equipment in machine tools, mining, aeronautics, marine engines, agriculture, and lifting devices. Offers a wealth of information on hydraulic packing, fluid media, and the maintenance of hydraulic plants. *31 plates, 103 figures.* **$7.50**

• *Send for this book. Save postage by remitting with order. Book returnable if not satisfactory. Address Dept. AH-2.*

THE RONALD PRESS COMPANY
15 East 26th St., New York 10

Post Scripts of Industry
continued

representative, has been transferred from Chicago to Passaic, N. J. **Fred A. Cramer,** who has been selling the divisions products in Minnesota and the Dakotas is now district representative in Chicago. **William W. Schmidt,** district representative in the south and western portion of Minnesota, North Dakota and South Dakota, with headquarters in Minneapolis. **Walter W. Schlegel** has been transferred to Indianapolis. He previously covered Missouri, Kansas and Nebraska. These three states will now be covered by **Donald D. Brock,** with headquarters in Mission, Kansas.

Clark J. Hawes was named by **James-Pond-Clark** as district factory sales engineer for the Philadelphia area.

Frederick A. Fielder has been named assistant to the general manager of **Loewy Construction Co.** Fielder has been with the Loewy organization for several years as project and procurement coordinator of the U. S. Air Force heavy press program.

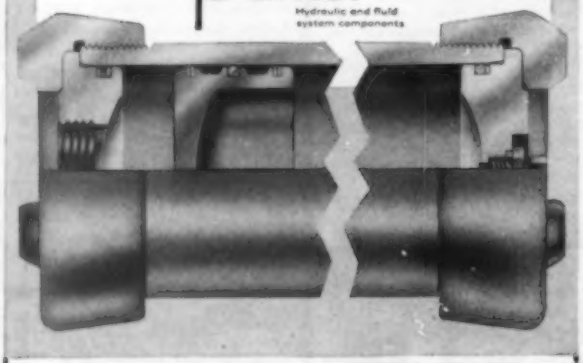
Frederick A. Fielder
Loewy Construction Co.

Use Parker hydraulic accumulators for less maintenance, longer life

- Piston type . . . compact.
- 3000 psi operating pressure.
- 11 sizes, from 10 to 1155 cubic inch capacity.
- Simple, strong construction.
- Provides steady power, absorbs pressure shocks.
- Permits smaller pump.
- Can function as leakage or thermal expansion compensator.
- Can serve as auxiliary or emergency source of power.

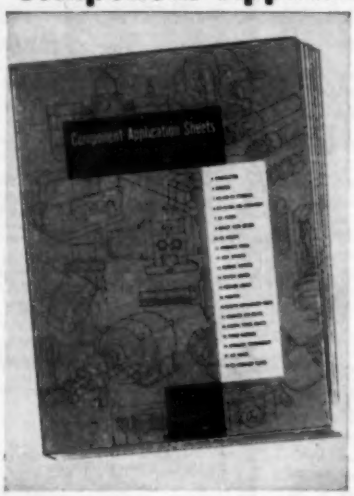
For further details, request Catalog 1536

Parker
Hydraulic and fluid system components



Order from your Hydraulics Jobber—or Industrial Hydraulics Division, Section 251-R, Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio

Component Application Sheets



This 32 page booklet describes air and oil components.

It tells:

- where they're used
- size range
- how they operate
- construction

Provides an excellent training aid.

INDUSTRIAL PUBLISHING GROUP
1240 ONTARIO ST., CLEVELAND 13, OHIO

Please send me ..... copy(ies) of "Component Application Sheets" at 50 cents each. Check is enclosed.

Name .....

Street .....

City ..... State .....

J. N. Fauver Company, Inc., has named **Robert Burrington** as Kalamazoo representative. He will cover the southwestern Michigan and northern Indiana territory.

Appointment of **H. J. Buttner** as manager of engineering for the **Le Roi Division of Westinghouse Air Brake Company** has been announced. Before joining the company, Buttner served as assistant director, director and manager of the Contract Division of Continental Motor Corporation. He has had over 25 years engineering experience and has been responsible for creating a complete combustion research facility. From 1946 to 1952 Buttner has also served on the Purdue University faculty.

Hydro-Air Engineering, Inc., St. Louis, has been appointed as distributor for the complete line of

W. G. Moehlenpah
Hydro-Air Engineering, Inc.

products manufactured by **Fluid Controls, Inc. W. G. Moehlenpah,** president of the company, founded Hydro-Air Engineering in 1953. The company which is devoted to the air and hydraulic field will cover the territory of eastern Kansas, eastern Nebraska, Iowa, Missouri and southern Illinois.

Additions to the sales and service staff of **E. F. Houghton & Co.,** have been announced. **C. Guy Rivers** has become technical sales engineer in the Philadelphia area, southern New Jersey and the state of Delaware. **Edward L. Babcock** was named as hydraulic engineer in the central New England area.

Continued on next page

Teflon*... SHEET

Your Best Source Is JOHN CRANE

Thickness Inches	Nominal Size
1/16	12 x 12
3/32	18 x 18
1/8	24 x 24
3/16	36 x 36*
1/4	48 x 48*
3/8	
1/2 & Up	

* Can be furnished in 1/2 sheets

ROD

DIAMETER INCHES	
1/4	1
5/16	1 1/16
3/8	1 1/8
7/16	1 1/4
1/2	1 3/8
9/16	1 1/2
5/8	1 3/4
3/4	2
7/8	2 1/4
	2 1/2
	3

Other diameters on specification

TUBING

TYPICAL SIZES INCHES	
O. D.	I. D.
3/8	1/4
1/2	3/8
3/4	1/2
1	3/4
1 1/2	1
2 1/2	1 1/2
3	1 3/4

HERE'S WHY: You can order in quantity and in a wide variety of sizes—and be certain of complete uniformity throughout. Our strict density control assures you thoroughly non-porous Teflon—free from any flaws which might possibly affect your end use or product. Dimensions are accurate to your most critical tolerances—no rejects, waste of material or loss of time. You get product purity—Teflon at its best in every one of its remarkable characteristics. Delivery is prompt—you get the quantity you want when you want it.

Since the availability of Teflon, "John Crane" engineers have worked with Industry to successfully solve innumerable problems and develop new applications. *You can benefit from their experience and know-how.*

Characteristics of Teflon

CHEMICAL
Completely inert.

ELECTRICAL
Very high dielectric strength.
Extremely low power factor.

THERMAL
Temperature range
—300° to +500° F.

MECHANICAL
Strong, flexible, weather resistant.

LOW COEFFICIENT OF FRICTION
Absolutely non-stick.

* DuPont Trademark

Request full information and ask for our bulletin, **The Best in Teflon.** *Crane Packing Co., 1805 Cuyler Ave., Chicago 13, Ill.*
In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.

JOHN CRANE

CRANE PACKING COMPANY

Post Scripts of Industry
continued

Walter A. Reynolds has been named district manager of **The Garlock Packing Company's**

Walter A. Reynolds
The Garlock Packing Co.

Denver, Colorado, office. Reynolds first joined Garlock in 1927 as shipping clerk, served on sales force since 1932 apart from 1946-1951 when he was engaged in his own business.

Charles F. McKenna, Jr., was elected treasurer of **Johnson & Hoffman Company,** an associate of Superior Tube Company. **Elmer W. Hayes** was appointed acting director of purchases at Superior Tube, succeeding McKenna.

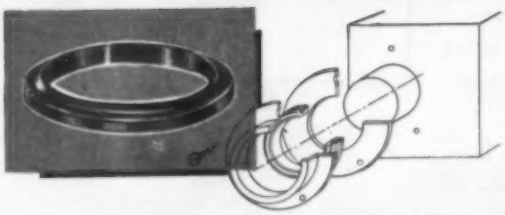
Two new appointments have been made at the **Pacific Division of Bendix Aviation Corporation. Donald W. Tait** has become supervisor of advertising and public relations, and **David H. Brown** was named assistant general manager. Brown has been with Bendix since 1938 when he joined the company as draftsman. Since 1946 he was works manager. Prior to joining Bendix, Tait held positions of manager of advertising and sales promotion at Raytheon Manufacturing Co.

Donald W. Tait
Pacific Div. Bendix Aviation Corp.

David H. Brown
Pacific Div. Bendix Aviation Corp.

NOW *"ON THE JOB INSTALLATION"* of

HYDRO-WYPE SCRAPER RINGS



Hydro-Wype Scraper Rings insure the maximum removal of dirt, dust, ice, snow and other abrasive materials from the piston rod as it moves in and out of the cylinder. Designed with a metal-to-metal fit and controlled breakout friction, Hydro-Wype Scraper Rings prevent foreign matter from cutting packings, scoring bearings and loss of hydraulic fluid.

The use of a Hydro-Wype Adapter enables you to install our Scraper Rings on your present equipment with a minimum of down-time and labor.

★ Manufactured on Government Specification MIL-S-5049 (AN62-31A)

★ Hydro-Wype Scraper Rings and Adapters are available, for rod sizes from 5/16" to 30" diameters

For additional details contact your Hydro-Wype representative

ATSCO 1927 SIEBENTHALER AVE. DAYTON 4, OHIO

NEW 'SHEAR-SEAL' AIR VALVE

Foot Operated 4-Way Valves With or Without Spring Return

DESCRIPTION: Foot operated 4-way valves for up to 250 P.S.I. air service. Port sizes ¼" and ⅜". With or without spring return (spring return to reverse or to center). Made entirely from corrosion resisting materials; stainless steel, bronze and aluminum.

FEATURES: Millions of service-free cycles even on *unlubricated* air; non-corrosive materials prevent galling or binding. Leak-proof to the end because "Shear-Seals" improve with use, cannot be scored or held open by dirt or pipe scale. Excellent throttling characteristics. Flexibility of porting reduces installation cost.

COST: $24.50 list price for a ¼", $25.50 for a ⅜" valve, less the usual trade and quantity discounts. Buy and try one on a money back guarantee or write for complete literature 2801.

BARKSDALE VALVES

5125 ALCOA AVENUE, LOS ANGELES 58, CALIFORNIA

Promotion of **Glenn O. Logan** to division manager of the Atlanta Sales Division of **Cleco Division of Reed Roller Bit Co.** Logan has been with the company in the Atlanta area as a special salesman since 1948.

William P. Lear, founder and chairman of the board of **Lear, Incorporated,** has established residence in Geneva, Switzerland. Lear will explore product designs and manufacturing techniques abroad, developing license arrangements and certain activities under his direction may involve early research and development of untapped resources of technical intelligence and fine precision techniques.

Wales-Strippit Corporation elected **Homer C. Gray, Jr.** to the board of directors and appointed him as vice president and director of sales. He joined the company in 1945 as assistant chief engineer, transferred to the sales department in 1947 and was made Midwest Division manager in 1950.

Homer C. Gray, Jr.
Wales-Strippit Corporation

A. W. Cash Co., has named the following new representatives. **The David J. Rank Co.,** Louisville, Ky., covering most of Kentucky and part of Indiana; **Bert Gurney & Associates,** Omaha, Nebr., serving East Nebraska, West Iowa and part of South Dakota; and **Consolidated Engineering Sales Company,** Cincinnati, Ohio, the territory includes Southwestern Ohio.

Continued on next page

Circle 10 on Reader Service Card

ANCO
COMPONENTS
for VAPORS and LIQUIDS

- **HIGH & LOW PRESSURE ROTARY JOINTS**
  balanced piston uses line pressure to control friction
- **GAGE PROTECTOR VALVE**
  design eliminates pressure surges and pulsations at the gage
- **SWIVEL JOINT**
  amazingly low swivelling torque reduces power loss and wear
- **CHECK VALVE**
  positive sealing—full flow
- **PRESSURE RELIEF VALVE**
  relieves, equalizes pressures to predetermined setting

Write today—full engineering data on any or all Anco Products as listed.

ANCOR DIVISION
AMERICAN ASSOCIATES INC.
ONE BAKER STREET
PROVIDENCE 5, RHODE ISLAND

Hydraulic
CYLINDERS
to specification

AT your service — since 1918 — the most modern machine tools to handle up to 15" I. D., including the last word in honing equipment and the most accurate of precision gauging equipment. Everything we do is to specification. Expanded facilities permit prompt delivery of 1 or 1000 pieces in any material desired.

Call Erie 2-3664 - Send specifications to
AMERICAN HOLLOW BORING COMPANY
1954 Raspberry St., Erie, Pa.

have a special need for a packing that will seal better and last longer?

specify **Tannate®** LEATHER PACKINGS*

1. They're job engineered from start to finish by Rhoads Engineers. Rhoads Tannate Leather Packings provide an effective seal against hydraulic oils, oil emulsions, water and many other gases and liquids. They will not readily cold flow and unlike some packings which are slightly abrasive and score cylinders, Tannate Packings hone or polish metal surfaces through sliding action.

2. They're made from specially tanned leather to enable them to slide smoothly without chatter.

3. There are filters available for pressures from a few ounces to many thousands of pounds per square inch. Tannate packings can be made "rock hard" or flexible to meet your requirements.

4. They're precision molded and accurately finished to fit snugly against shafts and cylinder walls. The exacting dimensions to which Tannate packings are manufactured insures a leak-proof seal.

Send for the Rhoads Packing Data File. Write J. E. Rhoads 2100 W. 11th St., Wilmington 99, Del.

*Available as U, Vee Cup and Flange leathers and discs for hydraulic and pneumatic equipment.

RHOADS
INDUSTRIAL LEATHERS

WILMINGTON • NEW YORK • CHICAGO • ATLANTA

Post Scripts of Industry
continued

John C. Coonley, was elected president and member of the board of **The Hydraulic Press Manufacturing Company.** He fills the vacancy created last April. Coonley brings to the company an

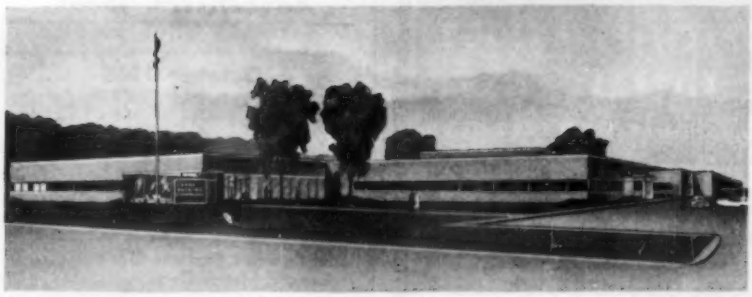
John C. Coonley
The Hydraulic Press Mfg. Co.

extensive background in the metal working and manufacturing industries. Until beginning of this year, Coonley was general manager of the valve division of A.C.F. Industries.

Promotion of **W. D. Rothell,** formerly sales engineer in Kansas City, to district manager of the West Coast district of **Stratoflex, Inc.,** has been announced. Rothell has been a member of the company since 1948.

W. D. Rothell
Stratoflex, Inc.

John T. Sacha has joined the **R. P. Adams Co., Inc.,** as sales engineer. Sacha will work out of the firm's home office. Prior to joining Adams he was associated with the Sprout Waldron Co., Inc.



Two new one-story buildings will complete the 17-acre home of **Crane Packing Corporation** on the outskirts of Morton Grove, Ill. The two new structures will house extensive research and laboratory operations as well as sales, executive and general offices and cafeteria. These two buildings, to be completed early in 1956, cover 46,500 square feet in addition to a 126,000 square feet factory building which is already in operation. Design and development work will be carried on in the electronic, nuclear and similarly rapidly advancing branches of modern industry.

Fielden Instrument Division, Robertshaw-Fulton Controls Company has opened a western regional sales engineering office at Lynwood, Calif. **Charles J. O'Lone,** former technical assistant to the sales manager will supervise this new operation.

Warren C. Wilson has been appointed advertising and public relations manager of **Servomechanisms, Inc.** Wilson, who in his new capacity will report to the vice president and general manager Harold R. Larsen, has been with the company for four years.

THE MARKET PLACE

REPRESENTATIVE WANTED

Prominent manufacturer of air and hydraulic cylinders has several territories available. Please advise experience, lines handled, territory, mode of operation and other pertinent data. Box 10155, APPLIED HYDRAULICS.

ENGINEERS, ELECTRONIC SCIENTISTS, METALLURGISTS, PHYSICISTS, PHYSIOLOGISTS, PSYCHOLOGISTS, TECHNOLOGISTS

The Naval Air Material Center, located at the Naval Base, Philadelphia, Pa., has vacancies in the above engineering and scientific positions which must be filled. The Center is engaged in an extensive program of aeronautical research, development, experimentation and test operations for the advancement of Naval Aviation. Engineering vacancies exist in the following options: Electrical, Electronics, General, Industrial, Mechanical, Structural and Aeronautical (various sub-options). Starting salaries range from $3670 to $8990 per annum. Application for Federal Employment, Standard Form 57, should be filled with the industrial Relations Department, Naval Air Material Center, Naval Base, Philadelphia 12, Pa. Applications may be obtained from the above address or information as to where they are available may be obtained from any first or second class post office.

Gresen
HYDRAULIC CONTROL VALVE
(Directional)

Model S.P.

- For Single or Double Acting Cylinders
- Pressures to 1500 PSI
- Built-in Adjustable Relief
- Ball Checks
- Openings—1/2" cylinder ports, 3/4" inlet and outlet.

Write for literature

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628 Calfax Ave. N. Dept. A-55 Minneapolis 11, Minn.

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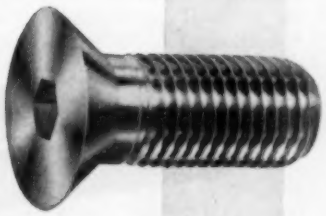
specify standard

UNBRAKO®



Flat Head
SOCKET CAP SCREWS

for assembling thin-section materials

Head design permits flush assembly. Uniform 82° angle under head provides maximum contact. Accurate hex socket assures positive, nonslip wrenching. Standard sizes—#4 to 3/4" in a full range of lengths—are stocked by authorized industrial distributors. Ask your supplier for Bulletin 877. Or write STANDARD PRESSED STEEL Co., Jenkintown 2, Pa.

UNBRAKO SOCKET SCREW DIVISION SPS JENKINTOWN PENNSYLVANIA

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Circle 24 on Reader Service Card

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Read Why

No matter what your hydraulic equipment there is a Briggs filter to meet your needs.

ASKANIA PUTS BRIGGS ON THEIR OWN HIGH PERFORMANCE EQUIPMENT.

1. DIRT FREE, ABRASIVE FREE FILTRATION ASSURES LONG LIFE OF HYDRAULIC FLUID AND EQUIPMENT.
2. REDUCES WEAR OF PUMPS AND VALVES.

Briggs — PIONEERS IN MODERN OIL FILTRATION

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YES! SEND ME YOUR FREE BOOKLET.

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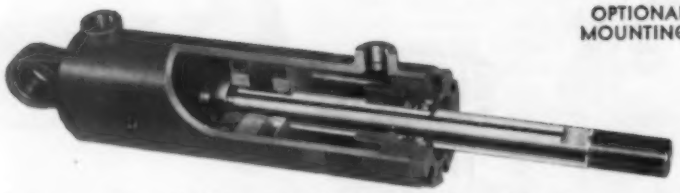
ADDRESS .....

COMPACT **DEPENDABLE** **EFFICIENT**

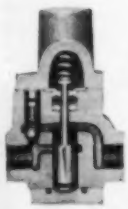
Piston Style, Double Acting
BHEW Hydraulic Cylinder

OPTIONAL MOUNTINGS



It's easy and practical to use BHEW hydraulic cylinders in your applications. Accurately honed barrels, hard chrome-plated rods, small O. D. and any type mounting desired are BHEW cylinder features. All types and sizes available in standard and special O. E. M. designs. BHEW makes single and double acting, high and low pressure cylinders with cup-type, ring-type or O-ring construction. Send specifications of your requirements.

BHEW



Pressure Operated Hydraulic Flow Control Valves, for lift trucks, eliminate surge as load starts down. Load weight controls rate of descent, full speed raising and empty fork travel. Write for details.

BENTON HARBOR ENGINEERING WORKS, Inc.

622 LANGLEY AVE. • ST. JOSEPH, MICHIGAN

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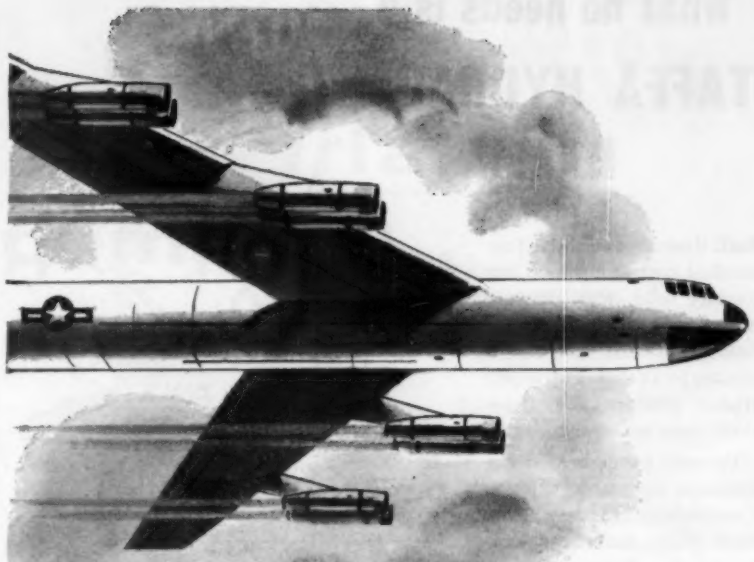
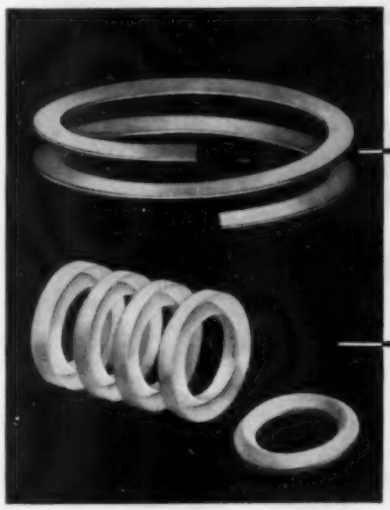


the Packings impervious to all hydraulic fluids

. . . made of *TEFLON*



Chemiseal hydraulic packings are made of pure duPont TEFLON to outlast other packing materials many times over. Chemically impervious, they have zero swelling in all hydrocarbons, new synthetic hydraulic fluids and solvents. Require no chemical inspection. Unmatched in anti-friction properties, tough, resilient, non-flammable, long wearing. Service temperature range is from minus 110°F to plus 500°F.

Try Chemiseal back-up rings that greatly lengthen "O"-ring life and prevent extrusion. Available in solid, split and spiral types in all commercial and AN sizes for "O"-ring packings, gaskets and universal fittings. Catalog OB-1152.

Try Chemiseal V-type packings for manual or automatically operated valves. Seal with low gland pressure and operating torque. Supplied with square-end TEFLON adaptors if required. Catalog TP-1053.

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USG | FABRICATORS OF FLUOROCARBONS & OTHER PLASTICS
Representatives in principal cities throughout the world

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What he needs is a

STAFFA HYDRAULIC RAM!

Staffa Rams are available in four standard ranges: high and low pressure solid, high pressure hollow and tubby rams. Loads from 1 to 150 tons. Pressures up to 5,000 p.s.i., strokes up to 36". Higher pressure and larger stroke rams are made specially.

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For pulling, pushing, lifting, pressing, clamping, bending or spreading.

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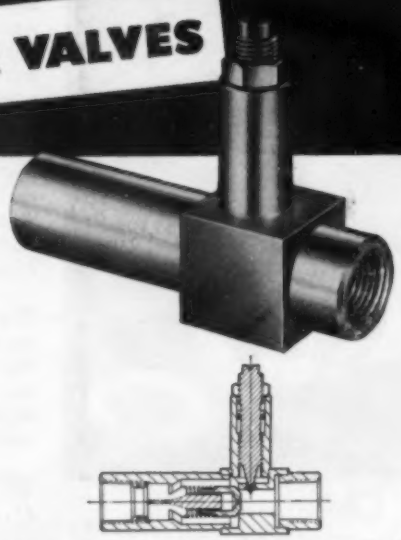
Telephone: LEYtonstone 3678.

DEPENDABLE

RESTRICTOR VALVES



- **CAN'T STICK OPEN** due to dirt in oil
- **HOLDS ADJUSTMENT** will not leak
- **STRONG** burst pressure over 10,000 P. S. I.
- ¼", ⅜", ½" and ¾" pipe sizes
- For oil at pressures to 3,000 P. S. I.

Write or phone Mentor, Ohio, Blackburn 5-2625 for complete specifications.

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Manufacturers of Hydraulic Valves and Devices
Relief Valves • Check Valves • Restrictor Valves
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Member Of The National Fluid Power Association

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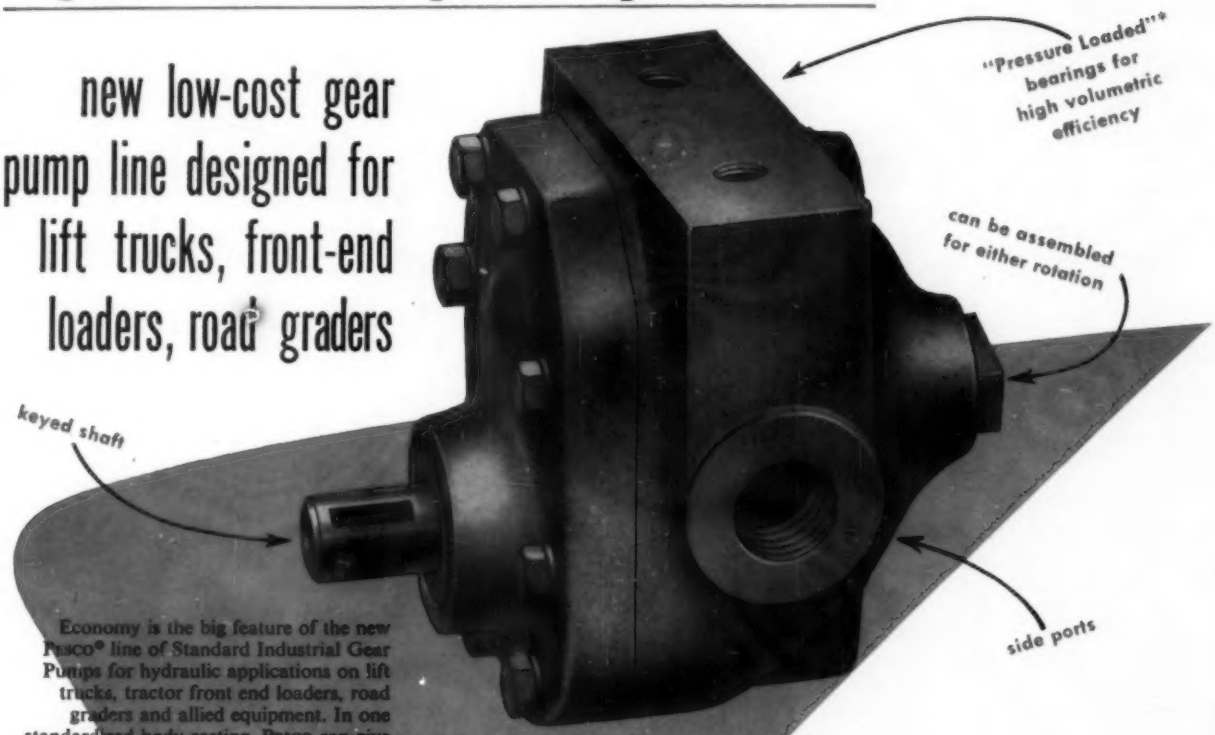
New from Pesco!

standard industrial hydraulic pumps . . .

new low-cost gear pump line designed for lift trucks, front-end loaders, road graders

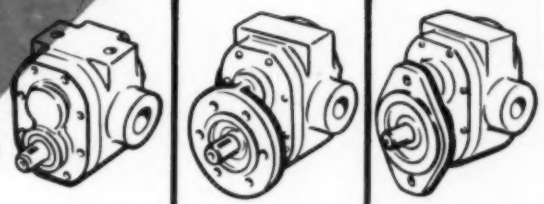


Economy is the big feature of the new Pesco® line of Standard Industrial Gear Pumps for hydraulic applications on lift trucks, tractor front end loaders, road graders and allied equipment. In one standardized body casting, Pesco can give you a choice of three displacement sizes and three mounting arrangements at a price you will want to investigate.

And these pumps are not built down to a price. They are Pesco quality in every aspect of design and manufacture. For example, they incorporate Pesco's patented "Pressure Loaded" bearings for maximum efficiency and sustained new pump performance throughout an extra-long service life.

If you want to build superior hydraulic performance *plus* economy into your off-the-road or materials handling equipment, get the full story on these new Pesco Pumps. Contact your local Pesco sales engineer or write: PESCO, 24700 North Miles Road, Bedford, Ohio.

three convenient mounting arrangements:



base | round flange | magneto flange

available in three popular capacities:

Pump Model Series	Rated Flow GPM	Displacement Cu. In.	Pressure PSI	Rated Speed RPM
051002	10.0	1.32	2000	2000
052973	12.0	1.56	2000	2000
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*Pesco's patented principle of gear pump construction.

engineering Pesco production

PRODUCTS DIVISION

BORG-WARNER CORPORATION

24700 NORTH MILES ROAD • BEDFORD, OHIO

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GOSHEN RUBBER *for* . . . . JOB-RIGHT SEALING

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In static applications TETRASEALS may save you money and grief over the type you're now using. They're non-laminated (in one homogeneous piece), and edges are accurately formed. What's more, cross-sectional tolerances can be held to ± .004 depending on inside and outside diameter, on size of cross-section and on material desired. Now available in materials to meet MIL, AMS, and commercial specifications. To find out what TETRASEAL can do for you, write for Technical Bulletin No. 11.

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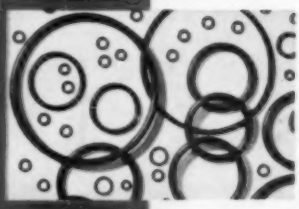
Finest facilities and technical know-how are constantly at work compounding materials and fabricating custom-designed parts to meet ever stricter requirements. Recent Goshen developments include synthetic rubber compounds, other than silicones, which withstand such severe temperature ranges as minus 65° F. to plus 300 F°.; and minus 20° F. to plus 400° F.



O-RINGS

Precisely molded O-rings, of natural, snythetic, and silicone rubbers, specially compounded by Goshen, to MIL, AMS, and commercial specifications, are helping cope with today's greater temperature range, higher pressures, and wide variety of acids, gases, and chemicals. When it comes to O-rings, let Goshen be your dependable source.

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If unable to attend, Send for Literature:

- ☐ TETRASEALS
- ☐ O-RINGS
- ☐ GORLUBE (Low Friction Treatment)
- ☐ GOSHEN'S CUSTOM FACILITIES

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